

Appendix E:

Town Traffic Model

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Town of Mammoth Lakes 2010 Traffic Model Quick Look

Purpose

The purpose of this modeling effort is to test a variety of possible new roadway connections, mode splits, and land use assumptions and assess the potential impacts the various scenarios may have on the overall transportation system in Mammoth Lakes.

Basics

- 167 Traffic Analysis Zones
- Design Day: Typical winter Saturday (average of Saturday ADTs from last 3 winter seasons measured on Main Street at Old Mammoth Road and at Lake Mary/Minaret Road)
- 20-year buildout horizon

Existing Conditions Model

The existing (2009) conditions model consists of existing land uses, roadway network, and traffic volumes. Existing traffic volumes are adjusted to reflect the “design day” and the “design day” volumes are used to calibrate the existing conditions model.

- Uses existing roadway network
- Uses existing land uses (from GIS)
- Comprehensive traffic volume data collected in January 2009
 - 18 intersections (turning movements)
 - 21 roadway locations (count stations)

“Buildout Baseline” Model

The “buildout baseline” serves as a starting point from which to test and compare alternatives or scenarios of buildout and how changes to the roadway network, increases in transit ridership, and changes to land use might impact overall traffic volumes.

- Existing roadway network
- Buildout “baseline” land uses
 - Units: based on PAOT methodology, including approved projects
 - Commercial/Industrial:
 - Approved projects
 - Assumes development of vacant land and redevelopment of some projects at a reasonable level in the Commercial General, Commercial Lodging, and Industrial zones (CG/CL = 0.25 FAR; Ind. 0.90 FAR)

Buildout Alternative Models (1 through 5)

Model alternatives were developed to represent a “layered” approach to future roadway network and land use changes, as described below. Table 1 provides a more detailed description of the model alternatives and Figure 1 illustrates the proposed roadway network additions.

- Alternative 1 – Models buildout “baseline” land uses with new streets that are anticipated to be implemented with new development.
- Alternative 2 – Models buildout “baseline” land uses with all new streets that would be anticipated to be constructed as part of the complete circulation network as recommended

by the Downtown Neighborhood District Planning Concept (DNDP) and Mobility Plan. (This alternative maintains the Main Street Frontage Roads)

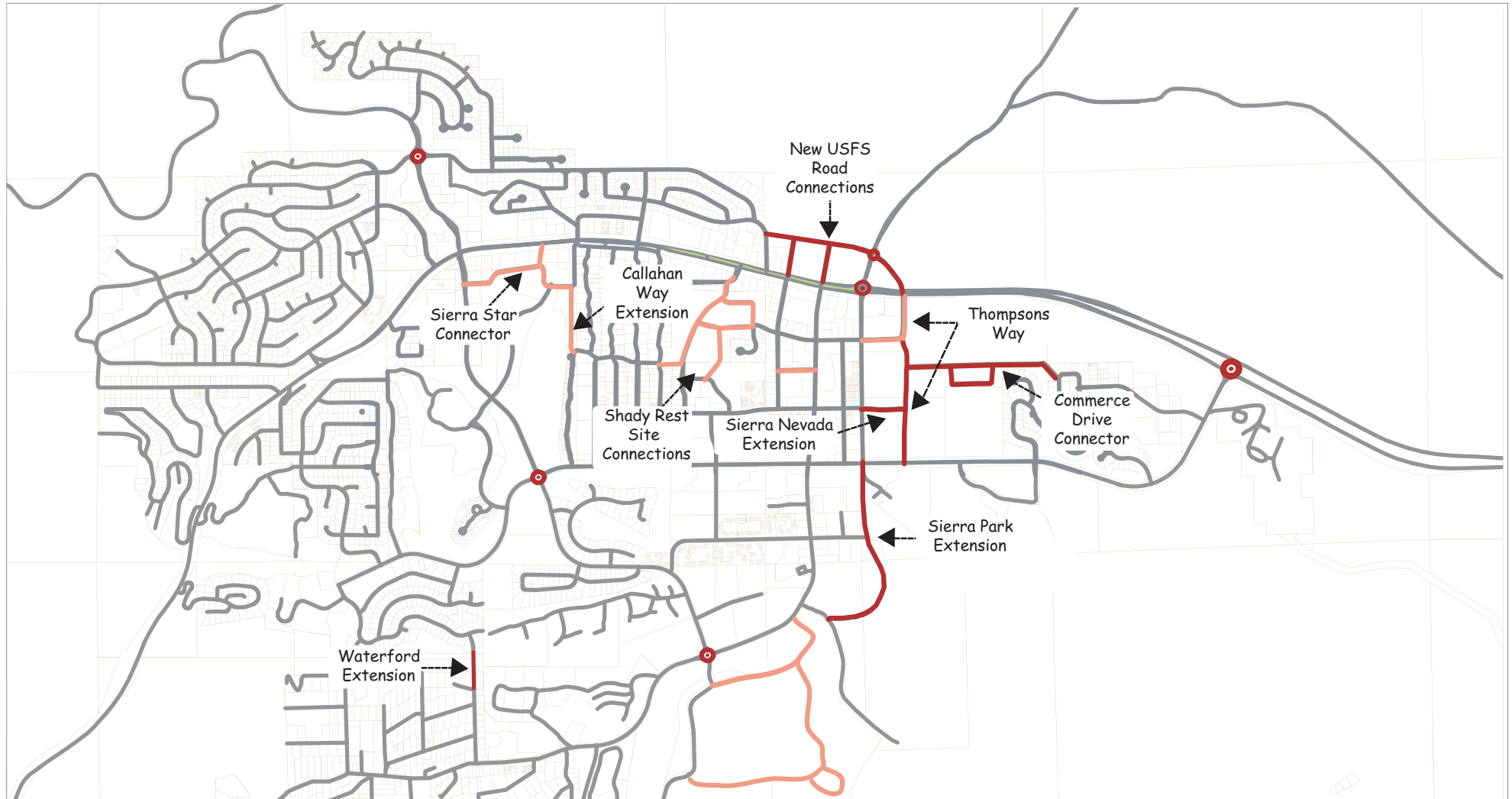
- Alternative 3 – Same as above Alternative 2; however, the Main Street Frontage Roads are removed.
- Alternative 4 – Same as Alternative 3; however, the land use assumptions are increased to include additional residential and commercial space possible under the DNDP.
- Alternative 5 – Same as Alternative 4; however, an additional transit line is added to Minaret Road to serve planned development.

Results

Preliminary intersection Level of Service (LOS) results are provided in Table 2. As shown, all existing *signalized* intersections operate at an acceptable LOS (LOS D or better) under current conditions and are expected to maintain an acceptable LOS under all future alternatives. LOS at the existing signalized intersections appears to improve modestly with the addition of new roadway links and transit service as modeled under the alternatives and there does not appear to be a significant impact to signalized intersection LOS under Alternatives 4 and 5, in which increased land use along Main Street associated with the DNDP was modeled.

However, as shown in Table 2, a number of existing *unsignalized* intersections currently operate, or are close to operating, at an unacceptable LOS (LOS D or worse), particularly along Main Street and Old Mammoth Road. The LOS for many of these intersections is expected to worsen under future buildout “baseline” conditions and to remain at unacceptable levels of service under all alternatives, even with the addition of new roadway links and transit service, if intersection improvements are not implemented (e.g. installation of roundabouts or signals).

PREFERRED ALTERNATIVE: CIRCULATION NETWORK



Downtown Neighborhood District Plan

Figure 1
Future Circulation
Network

- New Streets Implemented by Other Planned Development
- New Streets Recommended by DNDP
- Existing Streets



Proposed Roundabouts



Median - Greenway

0 200 400 800 1,200 1,600 2,000 2,400 Feet



Town of Mammoth Lakes

Table 1: Buildout Traffic Model Alternatives

Alt.		Description	Future Roadway Network	Future Land Use Assumptions	Other Assumptions
X	Buildout “Baseline” + Existing Network	<p>This alternative models buildout with the existing roadway network.</p> <p>Land use assumptions are based on PAOT and traffic model for residential uses and commercial/industrial land uses.</p>	Existing network	<ul style="list-style-type: none"> ○ Residential: use PAOT assumptions for units and rooms. ○ Commercial: Approved projects + 0.25 FAR for vacant/redevelopment land in CG/CL zones ○ Industrial: 0.9 FAR for vacant land in Industrial zone 	Transit share = 14%
1	Buildout “Baseline” + “Future Development Roads”	<p>This alternative models the existing roadway network plus roads that are reasonably expected to be built with future development. (The frontage roads are maintained in this alternative.)</p> <p>Land use assumptions are the same as above.</p>	Existing network plus Future Development Roads	Same as above	Transit share = 14%
2	Buildout “Baseline” + “Complete Circulation Network”	<p>This alternative models the existing roadway network plus roads that are recommended in the DNDP/Mobility Plan Complete Circulation Network. (The frontage roads are maintained in this alternative.)</p> <p>Land use assumptions are the same as above.</p>	Existing network plus “Complete Circulation Network”	Same as above	Transit share = 14%
3	Buildout “Baseline” + “Complete Circulation Network” (No Frontage Roads)	<p>This alternative models the existing roadway network plus roads that are recommended in the DNDP/Mobility Plan Complete Circulation Network. The frontage roads are removed in this alternative.</p> <p>Land use assumptions are the same as above.</p>	Existing network plus “Complete Circulation Network” – Frontage Roads	Same as above	Transit share = 14%

Alt.		Description	Future Roadway Network	Future Land Use	Other Assumptions
4	Buildout “DNDP” + “Complete Circulation Network” (No Frontage Roads)	<p>This alternative models the existing roadway network plus roads that are recommended in the Mobility Plan/DNDP Complete Circulation Network. The frontage roads are removed in this alternative.</p> <p>Land use assumptions are increased from the alternatives above to include rooms/units and commercial space possible under the DNDP.</p>	Existing network plus “Complete Circulation Network” minus Frontage Roads	<ul style="list-style-type: none"> ○ Additional units/rooms and commercial square footage available due to ROW relinquishment in DNDP Study Area (4 acres/175,000 sq. ft. additional) between Manzanita and Sierra Park). <ul style="list-style-type: none"> ▪ Residential: Additional 320 rooms possible at 80 rpa ▪ Commercial (CG/CL): 175,000 sq. ft additional. Need to determine appropriate FAR. ○ RV Park – New Sports/Events Park ○ FS Compound – New Civic Center, Retail and MF Res units <ul style="list-style-type: none"> ▪ 30,000 sq. ft. additional retail ▪ 82 MF units ○ Industrial: 0.9 FAR for vacant land in Industrial zone 	Transit share = 13% (transit share decreased slightly due to increased land use)
	Buildout “DNDP” + “Complete Circulation Network” (No Frontage Roads) + Increased Transit	<p>Roadway network is the same as Alternative 4, but transit ridership is increased by adding a transit line to Minaret Road from Snowcreek to Main Lodge and increasing frequency on existing lines.</p> <p>Land use assumptions are the same as Alternative 4.</p>	Same as Alternative 4 with additional transit	Same as Alternative 4	Transit Share = 18 %

Table 2														
Future Alternatives Comparison - Intersection Level of Service Results ⁽¹⁾														
Intersection	Existing		Base Future		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Signalized	Overall Delay		Overall Delay		Overall Delay		Overall Delay		Overall Delay		Overall Delay		Overall Delay	
	Overall LOS	(sec./veh.)	Overall LOS	(sec./veh.)	Overall LOS	(sec./veh.)	Overall LOS	(sec./veh.)	Overall LOS	(sec./veh.)	Overall LOS	(sec./veh.)	Overall LOS	(sec./veh.)
Lake Mary Road/Canyon Boulevard	A	9.2	A	8.8	A	9.4	A	9.4	A	9.2	A	9.4	A	9.1
Main Street/Minaret Road	C	29.7	D	37.2	C	33.4	C	32.6	C	32.7	C	33.8	C	31.8
Main Street/Old Mammoth Road	B	14.3	B	14.8	B	14.5	B	14.1	B	14.0	B	14.0	B	14.2
Meridian Boulevard/Minaret Road	B	15.5	C	22.0	C	22.0	C	21.2	C	20.9	C	21.3	C	20.2
Meridian Boulevard/Old Mammoth Road	B	19.7	C	22.6	C	21.9	C	22.1	C	20.9	C	22.1	C	21.9
Unsignalized	Critical		Critical		Critical		Critical		Critical		Critical		Critical	
	Critical Approach LOS	Approach Delay (sec./veh.) ⁽²⁾	Critical Approach LOS	Approach Delay (sec./veh.) ⁽²⁾	Critical Approach LOS	Approach Delay (sec./veh.) ⁽²⁾	Critical Approach LOS	Approach Delay (sec./veh.) ⁽²⁾	Critical Approach LOS	Approach Delay (sec./veh.) ⁽²⁾	Critical Approach LOS	Approach Delay (sec./veh.)	Critical Approach LOS	Approach Delay (sec./veh.)
Minaret Road/Forest Trail	F	0.37	F	1.24	F	0.94	F	1.02	F	1.03	F	0.91	F	0.76
Lake Mary Road/Davison Road/Kelley Road	B	12.9	B	14.4	B	14.4	B	14.9	B	14.7	B	14.9	B	14.2
Main Street/Mountain Boulevard	D	32.2	F	1.30	F	2.25	F	1.85	F	2.67	F	> 7.00	F	5.64
Main Street/Center Street	D	31.9	F	1.19	F	7.60	F	6.75	F	1.44	F	1.66	F	1.55
Main Street/Forest Trail	F	1.17	F	2.09	F	1.74	F	1.68	F	1.88	F	2.76	F	2.42
Main Street/Laurel Mountain Road	F	0.87	F	1.46	F	1.08	F	0.87	F	0.94	F	1.86	F	1.37
Main Street/Sierra Park Road/Sawmill Cutoff	B	13.4	C	16.3	C	16.5	C	16.5	C	16.3	C	16.9	C	16.9
Old Mammoth Road/Tavern Road	C	23.9	E	47.9	F	0.55	C	23.8	D	28.6	F	0.60	D	34.6
Old Mammoth Road/Sierra Nevada Road	E	35.4	F	1.00	F	0.66	F	0.54	F	0.55	F	0.84	F	0.77
Meridian Boulevard/Majestic Pines Drive	B	11.0	B	14.4	B	14.2	B	14.0	B	14.0	B	14.1	B	13.8
Meridian Boulevard/Sierra Park Road	A	8.2	A	8.4	A	8.4	A	8.4	A	8.3	A	8.3	A	8.3
Old Mammoth Road/Chateau Road	C	18.6	F	0.67	F	0.59	D	32.0	D	30.6	E	42.7	E	40.3
Old Mammoth Road/Minaret Road	B	14.5	F	6.44	F	1.27	F	1.07	F	1.18	F	1.26	F	1.10
Notes:														
(1) Performed in the <i>Synchro</i> capacity analysis software using the 2000 <i>Highway Capacity Manual</i> methodology.														
(2) For unsignalized intersections with a Level of Service "F", critical approach volume-to-capacity ratio is reported instead of delay.														

Town of Mammoth Lakes Travel Model



Prepared for



Town of Mammoth Lakes Travel Model

Final Report

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CHAPTER I

Introduction

This report documents the development of a computer-based transportation model for the Town of Mammoth Lakes, California. In addition to documenting the model itself, this report also presents an explanation of the development of land use quantities used in the model.

The Town of Mammoth Lakes had previously used the TRANPLAN modeling software, which was updated through 1998. For this project, a new model development effort has been completed using the TransCAD modeling software, borrowing some information from the previous model as described below.

The purpose of this model is to be able to test and assess changes to land use and the transportation system, and to thereby inform decision making for the benefit of the Town of Mammoth Lakes. The model is designed and intended for those types of decisions that go beyond site-level traffic impact studies usually required as part of the development review process. The model uses winter traffic levels as the basis for analysis.

OVERVIEW OF THE MODELING PROCESS

A transportation network model is a computerized representation of the transportation system. A model is useful for comparing the impacts of various growth assumptions and for evaluating alternative transportation improvement programs. Although it would also be possible to use growth factors based on recent trends to project future traffic and transit volumes, a model allows the use of better projections of growth within the area, accounting for subarea development. Computerized transportation models are also the best means by which to evaluate the flow of traffic between various land uses and to consider the effects of traffic congestion on travel times and driver route choice.

Among the various computer software modeling packages, the TransCAD software package was selected for the Town of Mammoth Lakes model as it provides the necessary modeling capabilities while providing GIS opportunities that can be used to coordinate transportation and land use planning and to better communicate the results of the traffic analyses in graphic form. In addition, it is well supported by its developer and is being used by many other agencies in the region.

Transportation models, by definition, are representations of travel choices made by individuals across a geographic area, impacting physical structures such as roads, bridges, parking areas, and intersections. Each model should rely on sound behavioral theory of how individuals make travel choices. The structure of choice sequences suggested by the model and the variables used in the model should reflect a logical process of decision making followed by travelers in deciding when, where, and how to travel.

The travel choices of individuals are most commonly represented in the United States by what is referred to as the “four-step process.” These four steps represent the thought process of the individual, who makes four travel decisions as follows: (1) the decision that a trip is necessary to fulfill some need or purpose (trip generation), (2) the decision where that need/purpose is best fulfilled (trip distribution), (3) the decision as to which means is best to get there (mode choice), and (4) the decision about which route to take (trip assignment). Trip generation is described in Chapter III, trip distribution in Chapter IV, mode choice in Chapter V, and trip assignment in Chapter VI.

Geographic patterns are represented by data considered to be at the heart of individual travel decisions—where people live, where people work, and where people recreate, shop, or otherwise interact. The specific data proposed for use in this project are discussed more fully below.

Land use quantities are represented by a series of Traffic Analysis Zones (TAZs). A total of 167 TAZs and three external stations were defined to encompass the model area. TAZs were generally defined to follow property lines and to accurately

reflect vehicular access to/from the roadway network. As discussed in detail below, land use quantities were developed to reflect existing uses within each TAZ.

The physical structures of travel are represented through a combination of links (paths) and nodes (intersections or transfer points). Zone centroids are special types of nodes associated with both the TAZ data mentioned above and the origins and destinations of an individual's trips. The links typically have a travel time associated with them, either explicitly given or inferred from speed and distance information.

As with any representation of a real system, there are associated limitations. To minimize the effects of these limitations, the model is “calibrated” so that it matches reality for all critical links in the system. In other words, adjustments are made until the modeled traffic volumes approximate existing traffic volumes, often referred to as “ground counts.” Once the model is calibrated, then and only then can the model be used to estimate future travel patterns and volumes.

MODEL STUDY AREA

The model was developed to encompass the Town of Mammoth Lakes in western Mono County. This includes portions of State Route (SR) 203 but does not include US 395. SR 203 becomes Main Street in town. The other major roads in the model are Minaret Road, Old Mammoth Road, and Meridian Boulevard.

The study area includes the following major ski base areas:

- Eagle Lodge
- Canyon Lodge
- Main Lodge (including the Mill Café area)
- North Village

The study area has the following external nodes:

- SR 203/Mammoth Scenic Loop north of Minaret Road
- SR 203 east of Meridian Boulevard and just west of US 395
- Minaret Road just west of the Main Lodge

Four other external nodes were considered but deemed unnecessary for a winter model. (See more below for discussion of the winter model design volumes.) The following roads are closed or have very little traffic in the winter.

- Sawmill cutoff north of SR 203/Main Street
- Mammoth Creek Road east of Old Mammoth Road
- Sherwin Creek Road east of Old Mammoth Road
- Lake Mary Road south of Old Mammoth Road

MODEL DESIGN AND PURPOSE

Each travel model has an intended purpose, with a base year to which the model is calibrated, and a future year toward which the model is intended to forecast. This travel model is intended to represent a typical winter Saturday under daily and peak-hour conditions. The model is intended to provide information about link volumes and intersection approach volumes. The model is also intended to provide information about transit boardings on a route and system level.

Although the approach volumes at intersections can be used in this manner, the travel model is not intended to specifically represent or produce turning count movement forecasts. Link volumes are inclusive of both roadway and transit route link volumes.

Although the model can be used to estimate volumes of boardings at specific transit stops, it is not intended to be completely accurate at this level for all routes. The model is, however, intended to be fairly accurate for the ski base areas and downtown so that parking, congestion, and mode splits are useful in these key locations.

Calibration Year

The base year for the model is 2009. Transportation and land use data from 2007 through 2009 have been used to calibrate the model and to adjust collected traffic data to the “design day.” The 2009 volumes that were collected were adjusted slightly higher than actual to account for trend line growth occurring in most recent years but not 2009 due to the downturn in national, state, and local economies. The remainder of this chapter sets the targets for calibration. Chapters

II through V describe the calibration process. Then Chapter VI shows how well the model matches the base year calibration targets.

Horizon Years

The model is intended to be used to forecast a “buildout” horizon year of 2030 or 2035 as determined by the Town of Mammoth Lakes. With the base year calibration complete and those results reviewed, future forecasting was undertaken. Additional checking for reasonableness was conducted to verify that each of the model’s four steps were producing results within the bounds of expected rates of growth in population, employment, skier visits, and other community indicators of travel as described in the Model Inputs chapter. The future-year reasonableness checks are presented in Chapter VII.

Trip Purposes

This travel model uses the following five trip purposes to describe the trip-making characteristics of individuals in Mammoth Lakes:

- H-REC (home-based recreation)
- H-S (home-based shopping)
- H-W (home-based work)
- H-O (home-based other)
- O-O (other trips)

All home-based trips start or end at the home. In other words, the purpose of the trip is to fulfill a need for the home, irrespective of the direction of the trip, whether from home to a destination, or the reverse, from a destination to home. For the model, home-based recreation is primarily a trip with skiing at one end and the home at the other end of the trip. Home-based shopping trips are primarily a trip with a retail store at one end and the home at the other end of the trip. Home-based work trips, are trips between work and home or home and work. Home-based other trips have a governmental, commercial, industrial, service, or other purpose at one end, with the home at the other end of the trip. Examples of home-based other trips may include, but are not limited to, trips to the post office, the auto mechanic, a lawyer or accountant, a doctor or dentist, or similar trips.

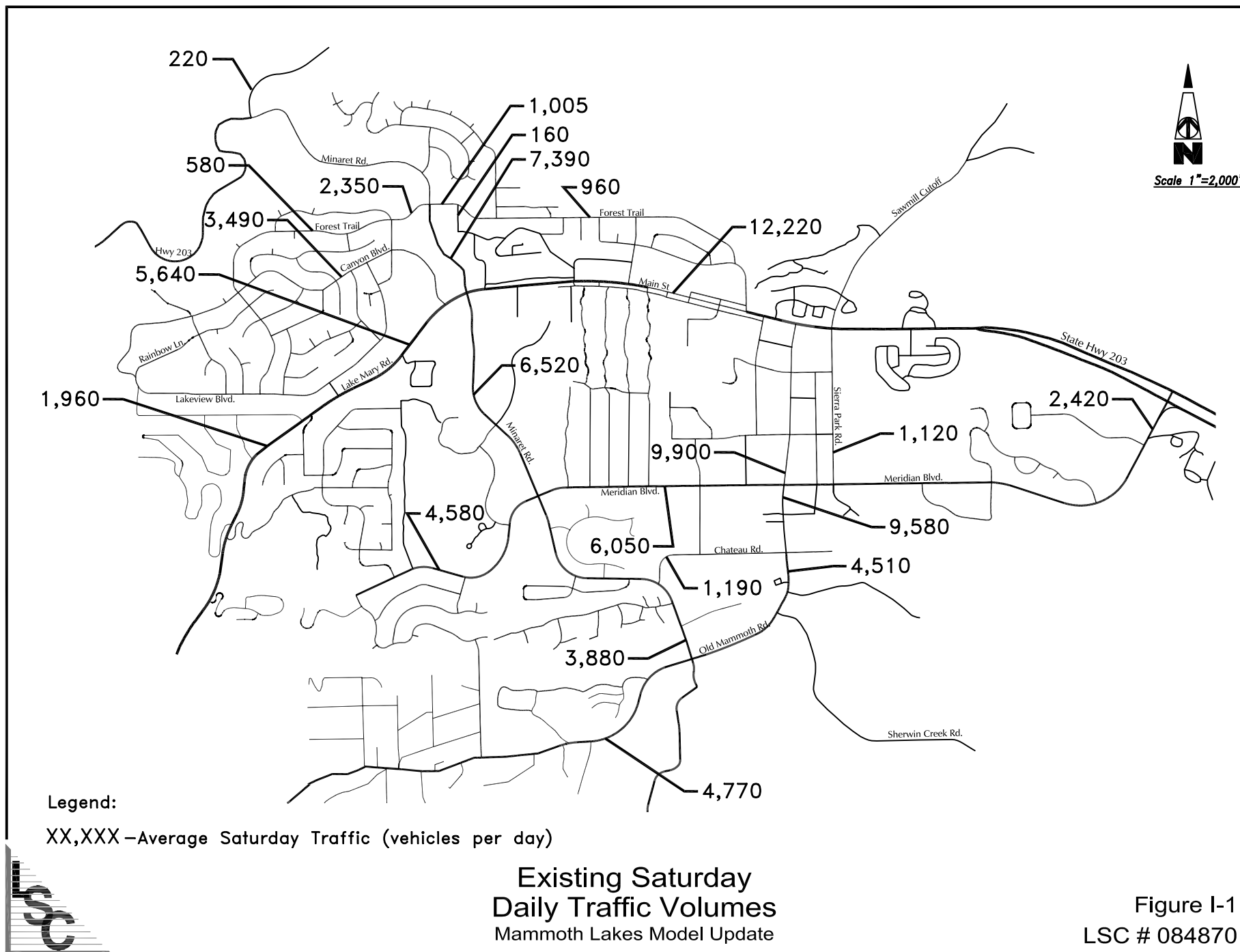
The O-O trips fulfill a purpose not associated with the home at either end of the trip. These trips are sometimes called non-home-based (NHB) trips. Going to lunch from work is a O-O trip because it fulfills the need to continue working. Going to the gas station between errands fulfills the need to continue making trips.

DEVELOPMENT OF WINTER 2009 DESIGN VOLUMES

A crucial step in development of a traffic model is determining the appropriate level of traffic volumes to use as the basis for the design of the model. This is particularly challenging in areas that experience large variations in traffic levels, such as in Mammoth Lakes where traffic volumes vary greatly by time of day, day of week, and by season depending on visitation trends.

To avoid the development or expansion of facilities that are needed only a relatively few days per year, or hours per year, it is standard practice to use a design volume level that is slightly less than the absolute peak traffic volume. In order to accomplish this, the Town of Mammoth Lakes uses the concept of the “typical winter Saturday peak hour” as the basis for the design of facilities. While daily traffic volumes in Mammoth Lakes are sometimes the highest in the summer months, the highest peak-hour volumes are typically experienced on winter Saturdays, during the afternoon hours when skiers “download” from the Mammoth Mountain Ski Area.

Existing 2009 winter Saturday design volumes for the study were developed through a sequence of steps. Weekday and Saturday 24-hour traffic counts were conducted at a total of eight locations throughout the Town of Mammoth Lakes. These counts were “tube counts” intended to obtain volumes in each direction of a road link (link volumes) between intersections. These counts were conducted from Wednesday, January 28, 2009 to Wednesday, February 4, 2009. These data were supplemented with 24-hour traffic counts taken by the Town’s permanent count stations. A total of 13 additional 24-hour counts were obtained for a total of 21 locations. A map showing the location and Saturday 24-hour volume at each location is presented in Figure I-1.



Introduction

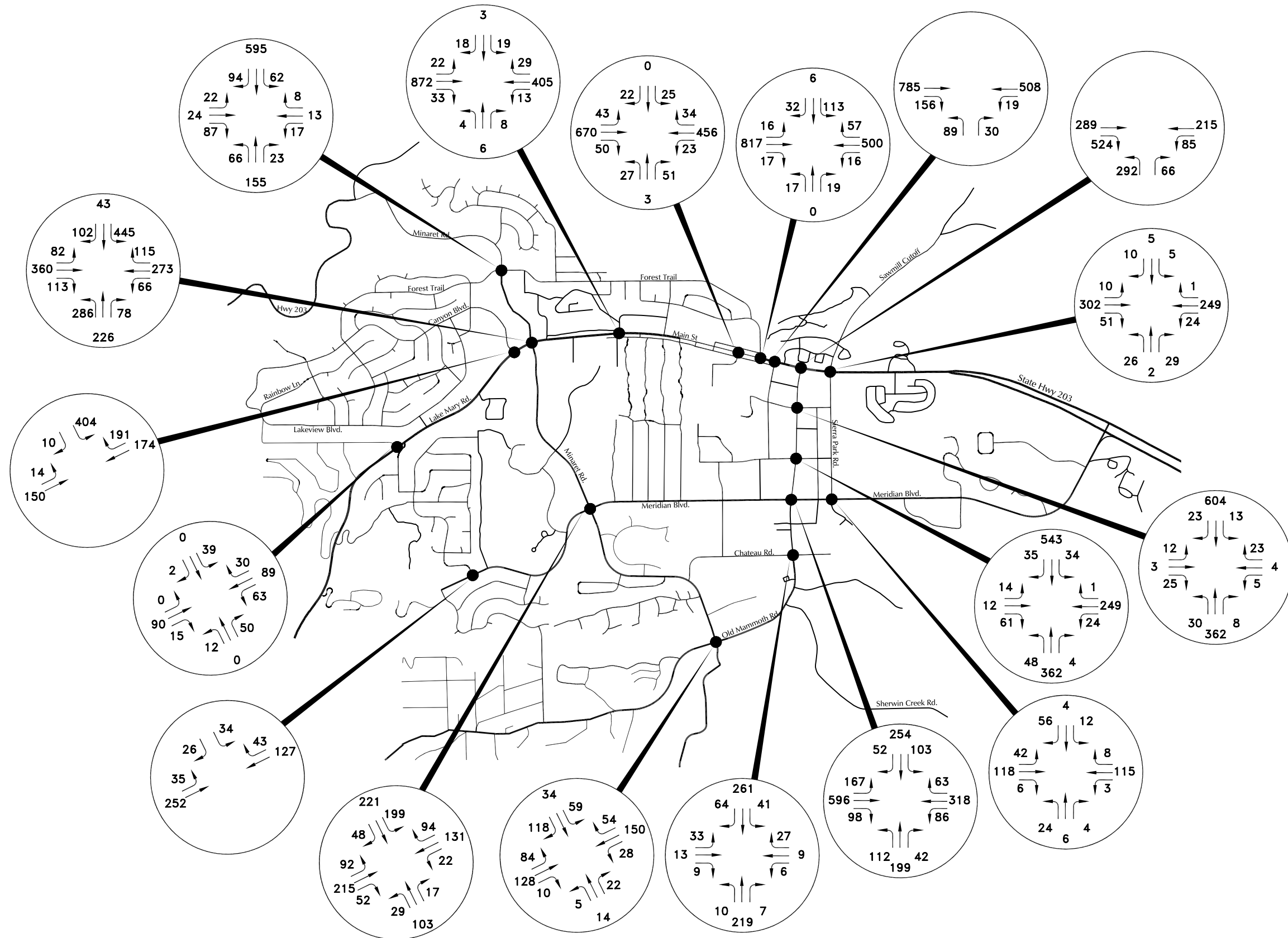
In addition to the 24-hour traffic counts, weekday and Saturday peak-hour intersection traffic counts were conducted at a total of 18 intersections on Friday, January 30, 2009 and Saturday, January 31, 2009. Intersection counts, also known as turning movement counts, are intended to show how many people make turns (left or right) or continue through an intersection without turning. A map showing the location of these intersections and the peak-hour volumes observed at each is presented in Figure I-2.

Legend:

xxx –Saturday peak-hour traffic (vehicles per hour)

Existing Saturday
 Peak-Hour Traffic Volumes
 Mammoth Lakes Model Update

Figure I-2
 LSC # 084870

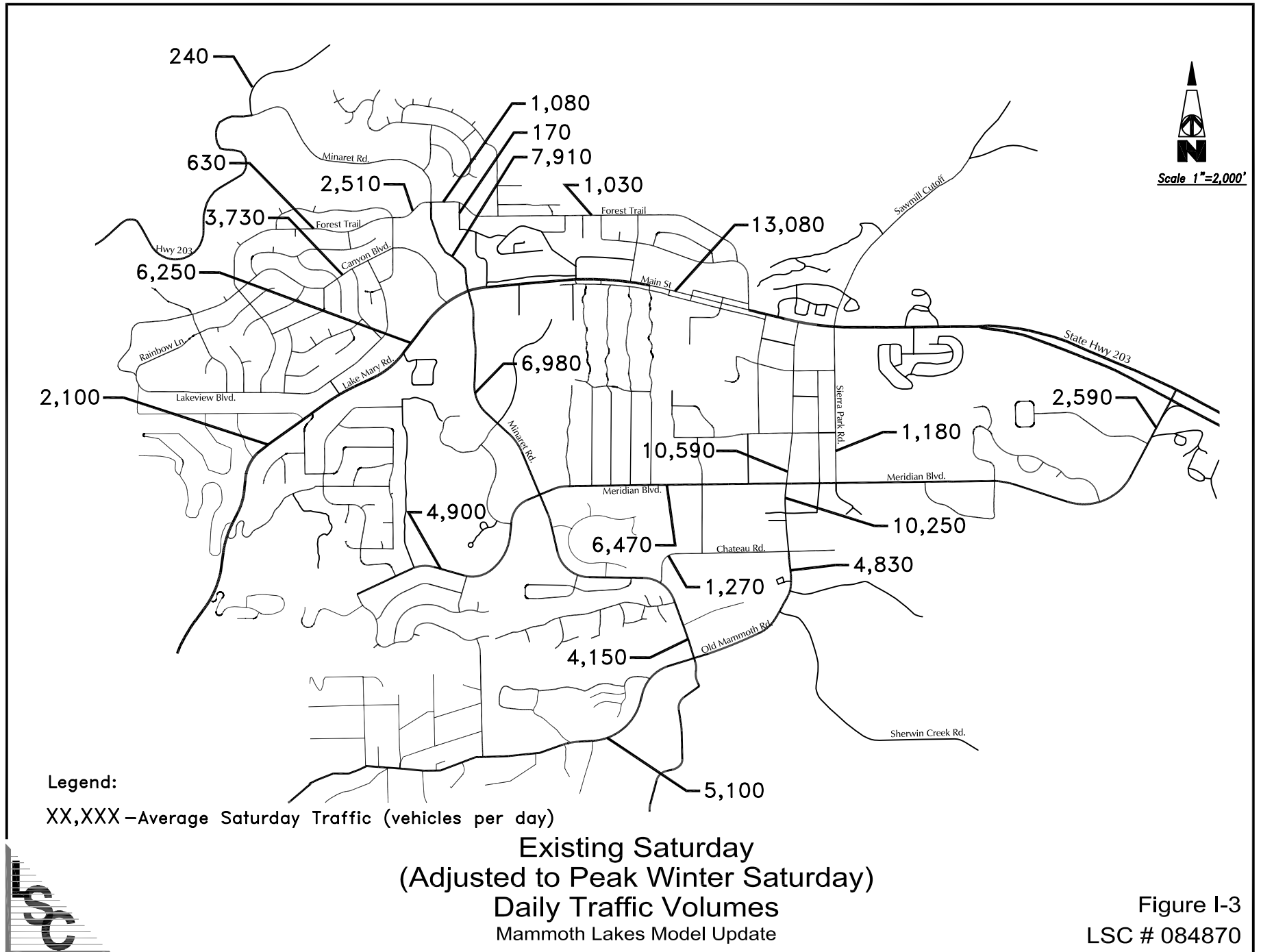


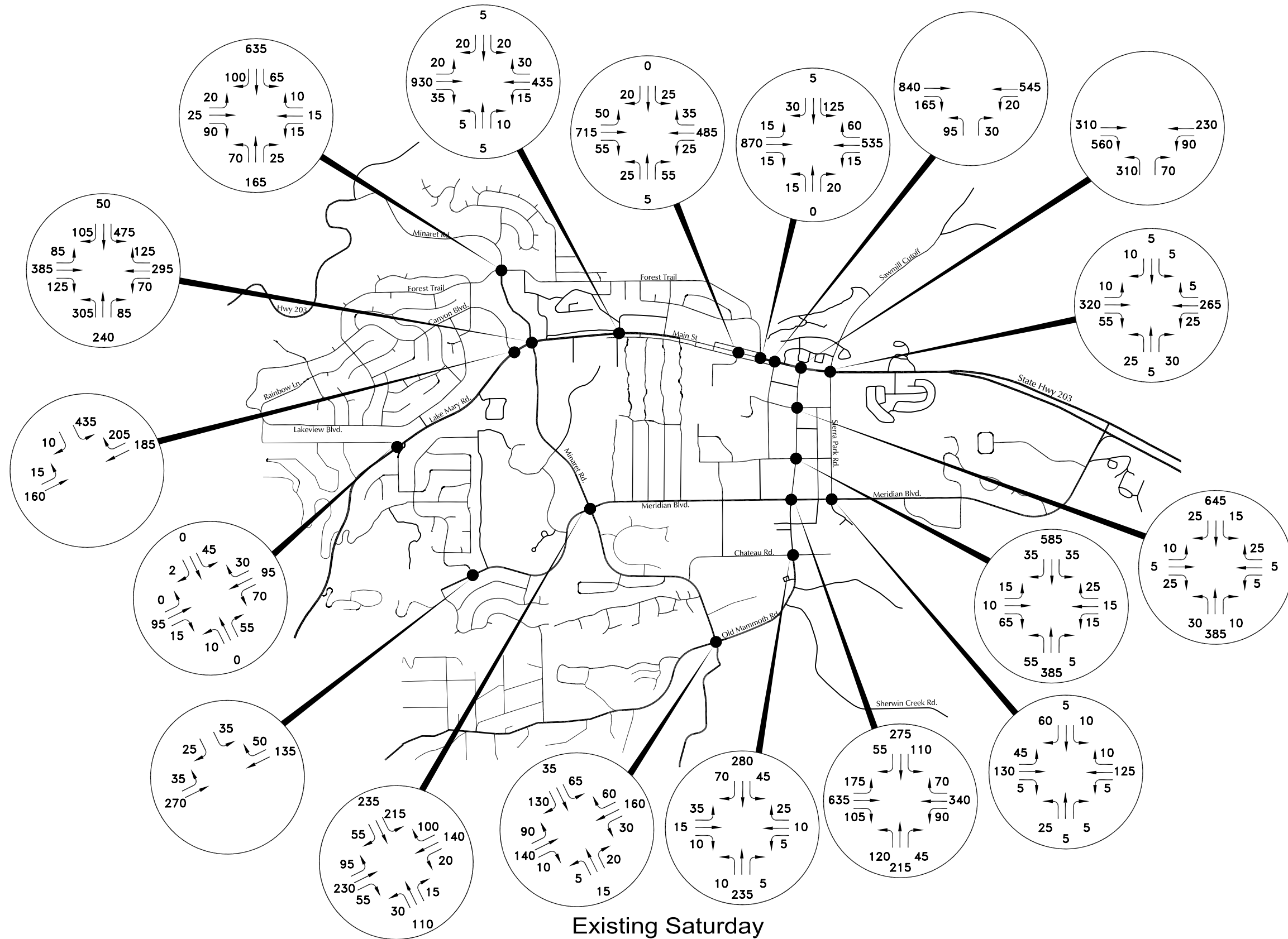
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To develop the travel demand model design hour, daily traffic volumes for each Saturday during the three recent winter seasons (06/07, 07/08, 08/09) were obtained from Caltrans' permanent count stations at two major intersections on Main Street (Old Mammoth Road, Lake Mary/Minaret Road). The volumes from each Saturday during these three winter seasons were averaged to determine the average daily traffic volume on Main Street during a "typical winter Saturday." The average daily volume was then compared to the average volume that occurred during the date of the Town's most recent extensive and comprehensive traffic volume survey, which occurred on Saturday, January 31, 2009 at all major intersections and roadway segments within Mammoth Lakes.

This comparison was used to develop a "factor" of 1.07, which was applied to the collected intersection and roadway segment volumes which were reported in Figures I-1 and I-2. The adjusted volumes are reported in Figures I-3 and I-4. The adjusted volumes are used to calibrate the travel demand model so that it more accurately represents a "typical winter Saturday."

It should also be noted that, consistent with standard analysis procedures elsewhere, level of service and capacity were not adjusted to account for snow conditions. The occurrence of stormy/snowy weather conditions and snow on the roadways occurs over a relatively small proportion of the winter and vehicle traffic generally decreases significantly in inclement weather conditions. Furthermore, it would be speculative to try to determine the impact to roadway capacity resulting from stormy conditions, as conditions are unique to each storm, as is driver behavior. This approach is consistent with other traffic analyses and travel demand models that LSC has prepared in similar areas with high annual snowfall, such as the Lake Tahoe region; Park City, Utah; and Aspen, Colorado.





Legend:

xxx – Saturday peak-hour traffic (vehicles per hour)

Note: Traffic volumes are rounded to nearest five.

Existing Saturday
 (Adjusted to Peak Winter Saturday)
 Peak-Hour Traffic Volumes
 Mammoth Lakes Model Update

Figure I-4
 LSC # 084870



CHAPTER II

Model Inputs

INTRODUCTION

This chapter reviews the input data used by and acted on by the four components of the travel demand model. Road and transit networks are defined and given performance characteristics. These characteristics answer questions about how (i.e., speed, direction, distance/length) trips move from place to place and how many trips can be accommodated on any given link. Existing (and future) land uses describe how many homes, jobs, shops, and other community opportunities exist in each place. Some additional data are also included to show how the final land use input table relates to other existing community information.

ROAD NETWORK AND ZONAL STRUCTURE

The transportation network in a travel demand model is a simplified representation of the real world. While it is simplified, it should contain all of the transport options available for individuals in order to have useful forecasting properties. The model represents the actual network as a series of links and nodes. TransCAD's mapping database was used to code the following data:

- Link speeds (free-flow based on posted speed limits)
- Directions of travel (one- or two-way)
- Link capacity (the product of lane capacity and number of lanes)
- Location of the end nodes
- Other attribute data (street name, classification, surface, other)

An existing link network in GIS format was obtained from the Town of Mammoth Lakes. This network was carefully reviewed to ensure a complete network that represents the study area roadway network and to remove minor unpaved roads not used for through traffic.

Facility Types

This road network was then classified into nine facility types. While default values were identified for each type, changes from these default values were made as part of the calibration process (as discussed below) to reflect differences in conditions, especially speeds in more congested areas or where site visits indicate speeds deviate substantially from posted speeds. However, the default values of each roadway type are shown in Table II-1.

Table II-1 Road Network Characteristics						
No.	Facility Type	Daily Capacity (ADT)	Hourly Capacity (vphpl)	Speed (mph)	# Links of Each Type	% Links of Each Type
0	Centroid Connector	n/a	n/a	25	194	18.7%
1	Highway	15,000 - 32,000	800	50-55	16	1.5%
2	Arterial	5,000 - 32,000	500-800	40-50	127	12.2%
3	Collector	4,000 - 5,000	400-500	25-40	147	14.2%
4	Local	2,500 - 5,000	250-500	25-40	421	40.6%
5	County Road	4,000	400	25	27	2.6%
6	Other	4,000	400	25	16	1.5%
7	Private	4,000	400	25	31	3.0%
8	Alley	4,000	400	25	10	1.0%
9	USFS Route	4,000	400	25	49	4.7%
Total					1,038	100.0%
Notes: vphpl = vehicles per hour per lane, mph = miles per hour, ADT = average daily traffic in all travel lanes both directions. Source: LSC, 2010.						

Capacity

Figure II-1 presents the capacity of the Town of Mammoth Lakes' model roadway network. These values are based upon standard values employed by the traffic engineering profession and are consistent with the values used in the previous versions of the model. The roadways with the greatest capacities are Meridian Boulevard and State Highway 203, which are coded to have capacities equal to 7,000 to 16,000 vehicles per day per direction. The next highest capacity roadways

are Old Mammoth Road and Minaret Road, which are assumed to have capacities between 3,500 and 7,500 vehicles per day per direction. The remaining roadways are coded to have capacities that are less than 4,500 vehicles per day per direction. Most of the lower capacity roadways are collectors or local streets.

The centroid links are shown in gray on Figure II-1. The capacity on the centroid links is considered to be unlimited. This is because centroid connectors represent a network of smaller roadway facilities for which the model is not intended to forecast. They are given unlimited capacity so there is no congestion or limit to flows on these facilities. These smaller roadway facilities include some local roads, alleys, and driveways.

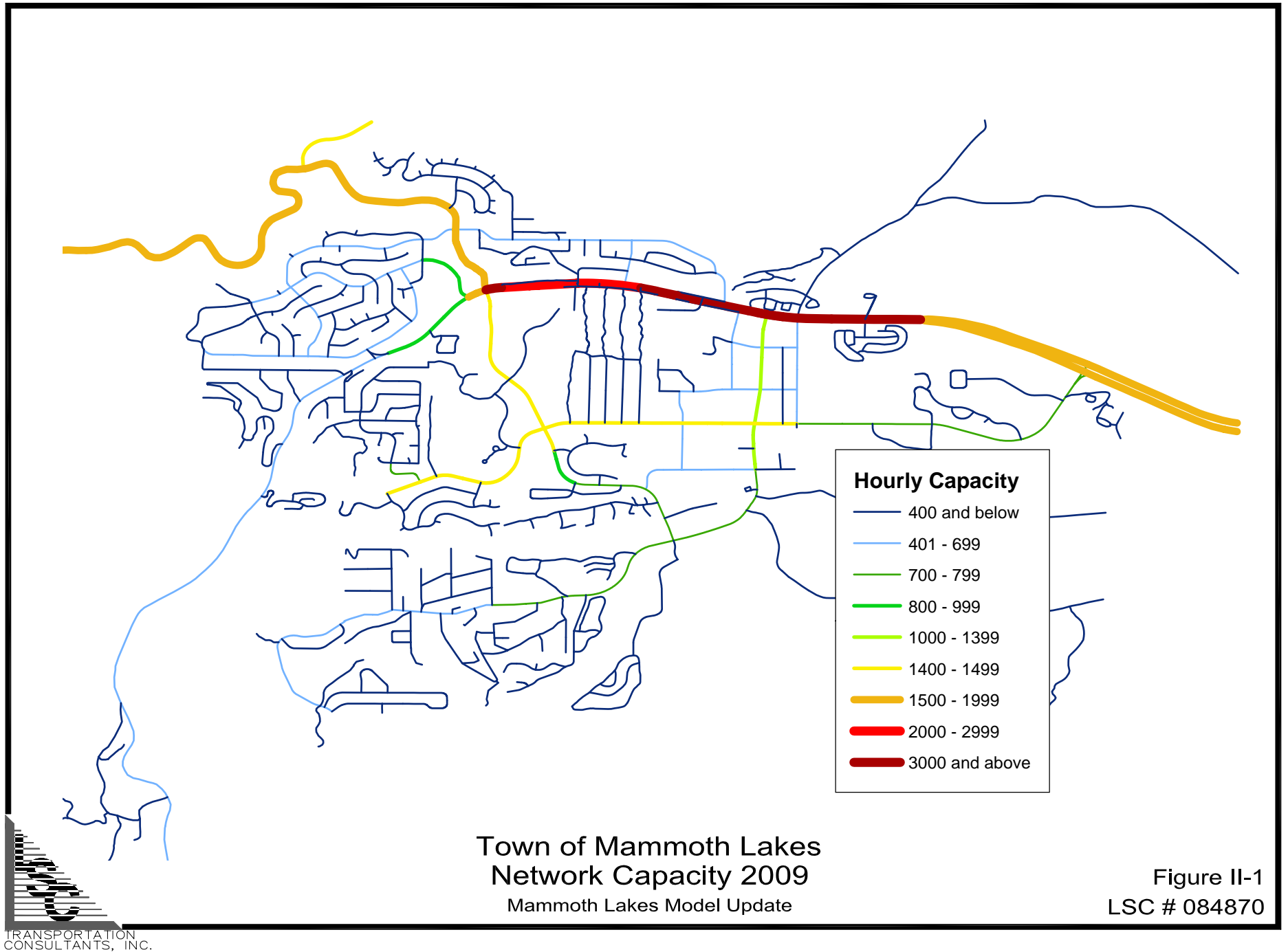


Figure II-1
LSC # 084870

Traffic Analysis Zone Structure

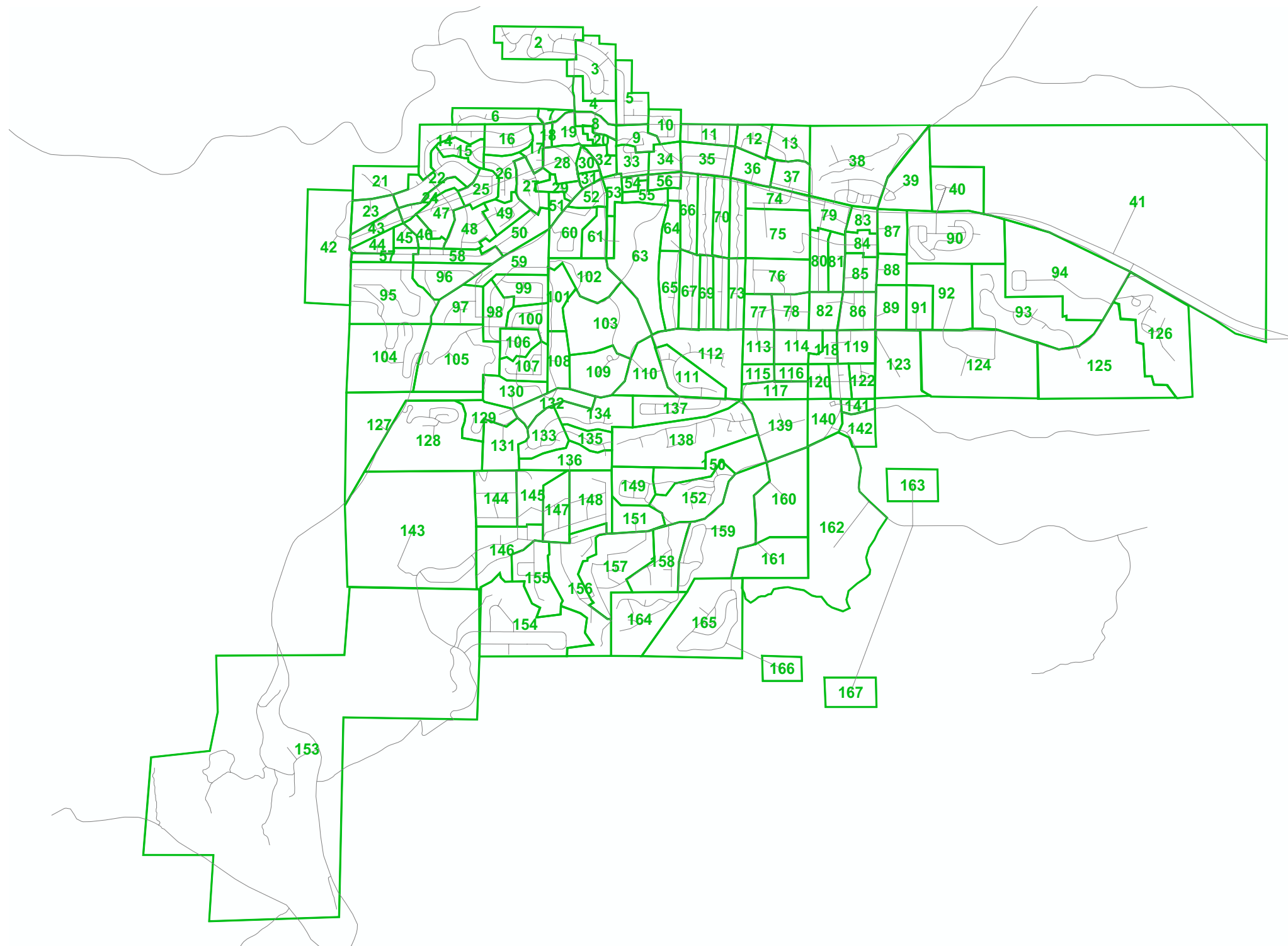
The next step in updating the Town of Mammoth Lakes' travel demand model was to review the existing model network and Traffic Analysis Zones (TAZ). The model network was last updated in 2005. Thus, a review was warranted to assure the current accuracy of the network input within the modeling process. The LSC team worked with the Town of Mammoth Lakes planning staff to determine the network revisions required in order to match the current network conditions. Based on this effort, the number of TAZs was increased from 152 to 167. The new TAZs were created to better represent certain areas in the new model. Specifically, the following areas were refined:

- Commercial parcels south of Lake Mary Road and west of Minaret Road.
- The area east of Old Mammoth Road and south of Meridian Boulevard including the Cerro Coso Community College and nearby utility parcels.
- Tamarack Lodge.
- The area south of Chateau Road and east of Old Mammoth Road.

In addition, several other TAZ boundaries were revised to better separate out different land use types.

The revised 2009 zone system, shown in Figure II-2, includes 167 centroid nodes and three external station nodes that correspond to 170 total TAZs. All of the socioeconomic and land use data are attached to the centroid nodes. There are 727 additional nodes where roadway segments connect to each other at intersections, turns, and access points from the adjacent land use developments (centroid nodes). The nodes are connected by 1,038 links that represent the roadway segments within the network. Each link has corresponding attributes that define the roadway in terms of distance, speed, number of lanes, and segment capacity.

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Town of Mammoth Lakes
 Traffic Analysis Zones 2009
 Mammoth Lakes Model Update

Figure II-2
 LSC # 084870



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Intersections

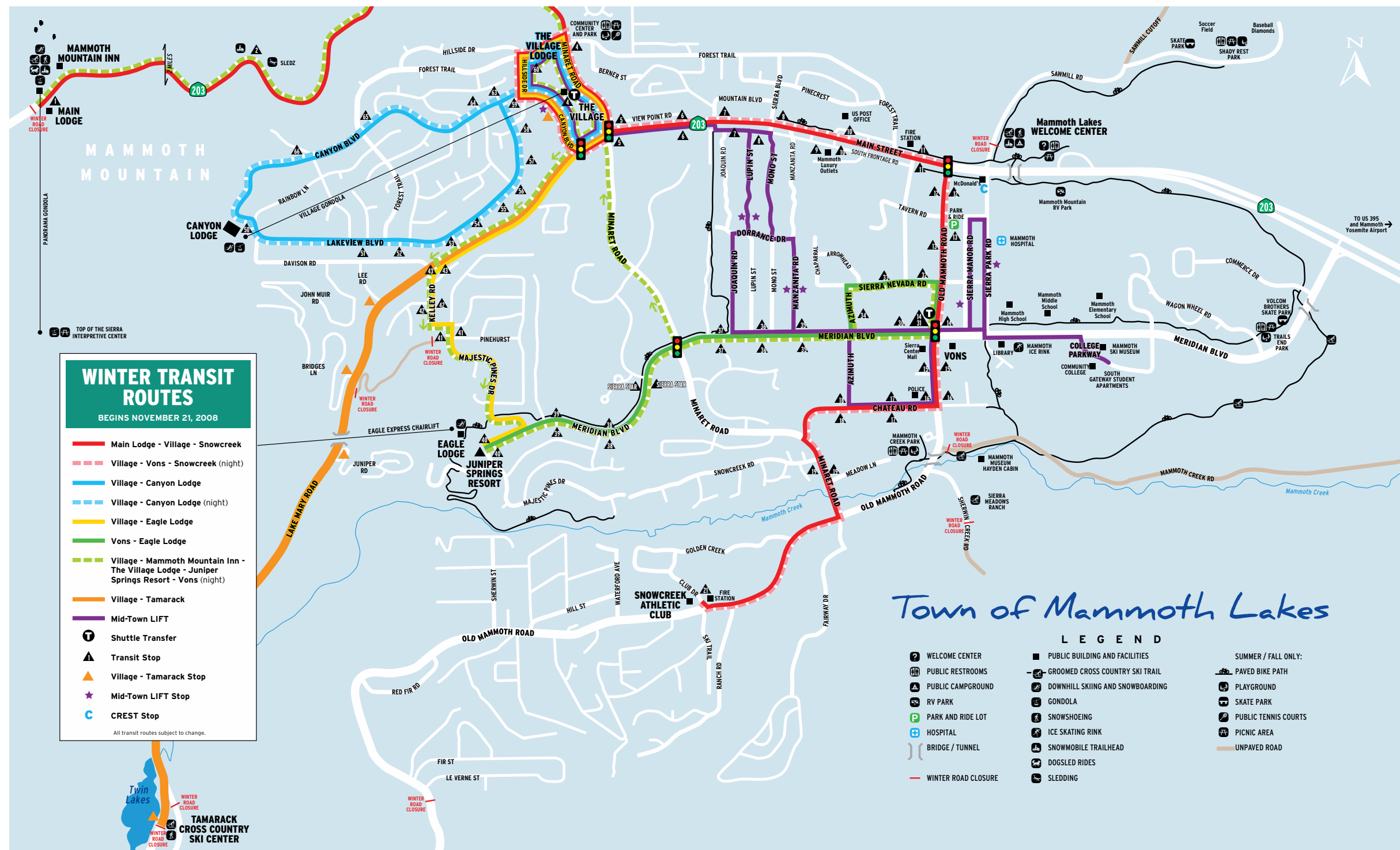
Table II-2 provides a list of 24 intersections of interest to the study. For 18 of the intersections, traffic counts were conducted in 2009. Six additional intersections are listed based upon their having been analyzed in prior studies. As the table indicates, there are currently five signalized intersections and one four-way stop-controlled intersection in town.

Table II-2 Intersection Listing		
Roadway Segment Extents		
North-South Street	East-West Street	Type of Control
Intersections of Major Roads		
Minaret Rd.*	Lake Mary Rd./Main Street	Signalized
Minaret Rd.*	Meridian Blvd.	Signalized
Canyon Blvd.*	Lake Mary Rd.	Signalized, 3-Leg
Old Mammoth Rd.*	Main Street	Signalized, 3-Leg
Old Mammoth Rd.*	Meridian Blvd.	Signalized
Forest Trail Between Main Street and Minaret Rd.		
Berner St.	Forest Trail	Stop on Berner St. Leg
Sierra Blvd.	Forest Trail	Stop on Sierra Blvd Leg
Main Street Between Sierra Park Rd./Sawmill Cutoff and Minaret Rd.		
Center St.*	Main Street	2-Way Stop on Center St.
Forest Trail*	Main Street	2-Way Stop on Forest Trail
Laurel Mountain	Main Street	2-Way Stop on Laurel Mountain
Mountain Blvd.*	Main Street	Stop on Sierra Blvd Leg
Sierra Park Rd./Sawmill Cutoff *	Main Street	2-Way Stop on Sierra Park/Sawmill
Meridian Blvd. Between SR 203 and Minaret Rd.		
Azimuth Dr.	Meridian Blvd.	2-Way Stop on Azimuth Dr.
Majestic Pines Dr.*	Meridian Blvd.	Stop on Majestic Pines Leg
Sierra Park Rd.*	Meridian Blvd.	4-Way Stop
Minaret Rd. Between Main Street and Mammoth Scenic Loop (SR 203)		
Minaret Rd.*	Forest Trail	2-Way Stop on Forest Trail
Minaret Rd. Between Main Street and Old Mammoth Rd.		
Minaret Rd.	Chateau Rd.	Stop on Chateau Leg
Minaret Rd.*	Old Mammoth Rd.	2-Way Stop on Minaret Rd.
Minaret Rd.	Sierra Star	2-Way Stop on Sierra Star
Lake Mary Road Between Minaret Rd. and Bridge Lane		
Lake Mary Rd.	Kelly Rd./Davidson	Split Intersection. Stops on both Kelly Rd. and Davidson
Lake Mary Rd.	Lakeview Blvd. Cutoff	Stop on Lakeview Blvd. Leg
Old Mammoth Rd. Between Main Street and Meridian Blvd.		
Old Mammoth Rd.*	Chateau Rd.	2-Way Stop On Chateau Rd.
Old Mammoth Rd.*	Sierra Nevada Rd.	2-Way Stop On Sierra Nevada Rd.
Old Mammoth Rd.*	Tavern Rd.	2-Way Stop On Tavern Rd.
Source: LSC 2009. *Intersection counts completed in 2009. See Figure I-2.		

TRANSIT NETWORK

Figure II-3 presents the existing bus transit network for the Town of Mammoth Lakes. The Village Gondola is also part of the transit network. The transit networks of previous models had coded the three main routes (Blue, Red, and Green), while this version of the model considers all six. Only daytime service and service frequencies are represented in the model. Table II-3 shows the model data attributed to each route. All services are represented in the model as being fare-free.

Table II-3 Transit Network Characteristics			
Name of Route	Route Color	Number of Route Stops	Frequency
Main Lodge-Village-Snowcreek	Red	36	15 minutes
Village-Canyon Lodge	Blue	17	15 minutes
Village-Eagle Lodge	Yellow	14	15 minutes
Vons-Eagle Lodge	Green	18	15 minutes
Village-Tamarack	Orange	8	60 minutes
Mid-Town Lift	Maroon	7	30 minutes
Village Gondola	n/a	2	20 seconds
Sources: Eastern Sierra Transit. Mammoth Transit Map, Winter 2009; Town of Mammoth Lakes and LSC for the number of stops, 2009.			



Town of Mammoth Lakes
Transit System - Winter 2009
Mammoth Lakes Model Update

Figure II-3
LSC # 084870

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EXISTING LAND USE DATA

The following information about land use data is presented as background to the creation of the final land use input table used in the travel model. Some information is also provided as supporting information for later chapters in this report.

Zoning and Land Use Districts

Figure II-4 shows the current Mammoth Lakes zoning. This is the color-coded representation of the data attached to the traffic analysis zones. Shown on this map, but excluded from the travel model, are the Lakes Basin open space and the Yosemite Airport.

Figure II-5 shows a map of 13 neighborhood districts and three mountain portals. The concept of districts is applied in the validation of the model during the trip distribution step, both to check trip-interchanges between districts as well as continuing the Town's land use planning into the travel model.

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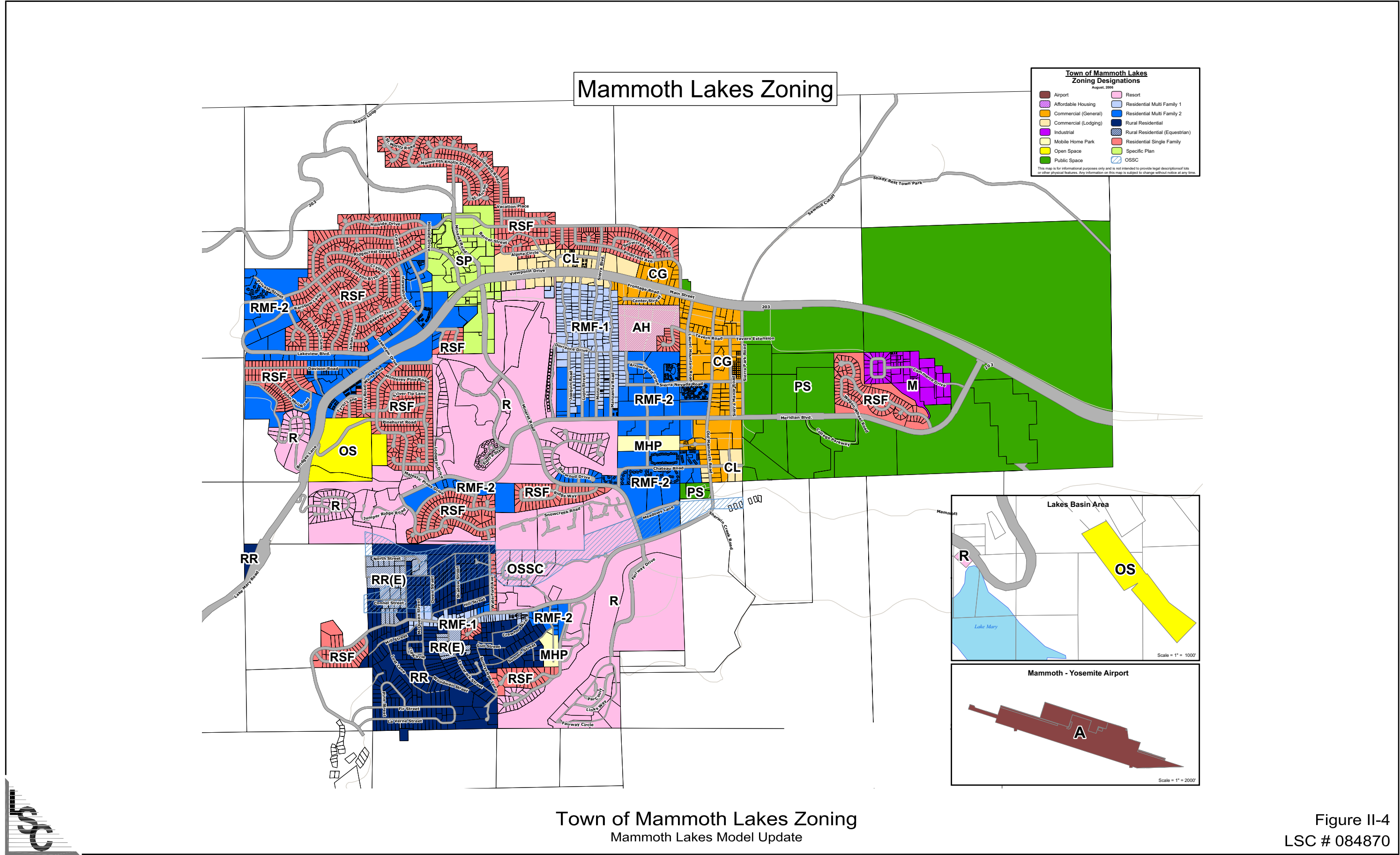
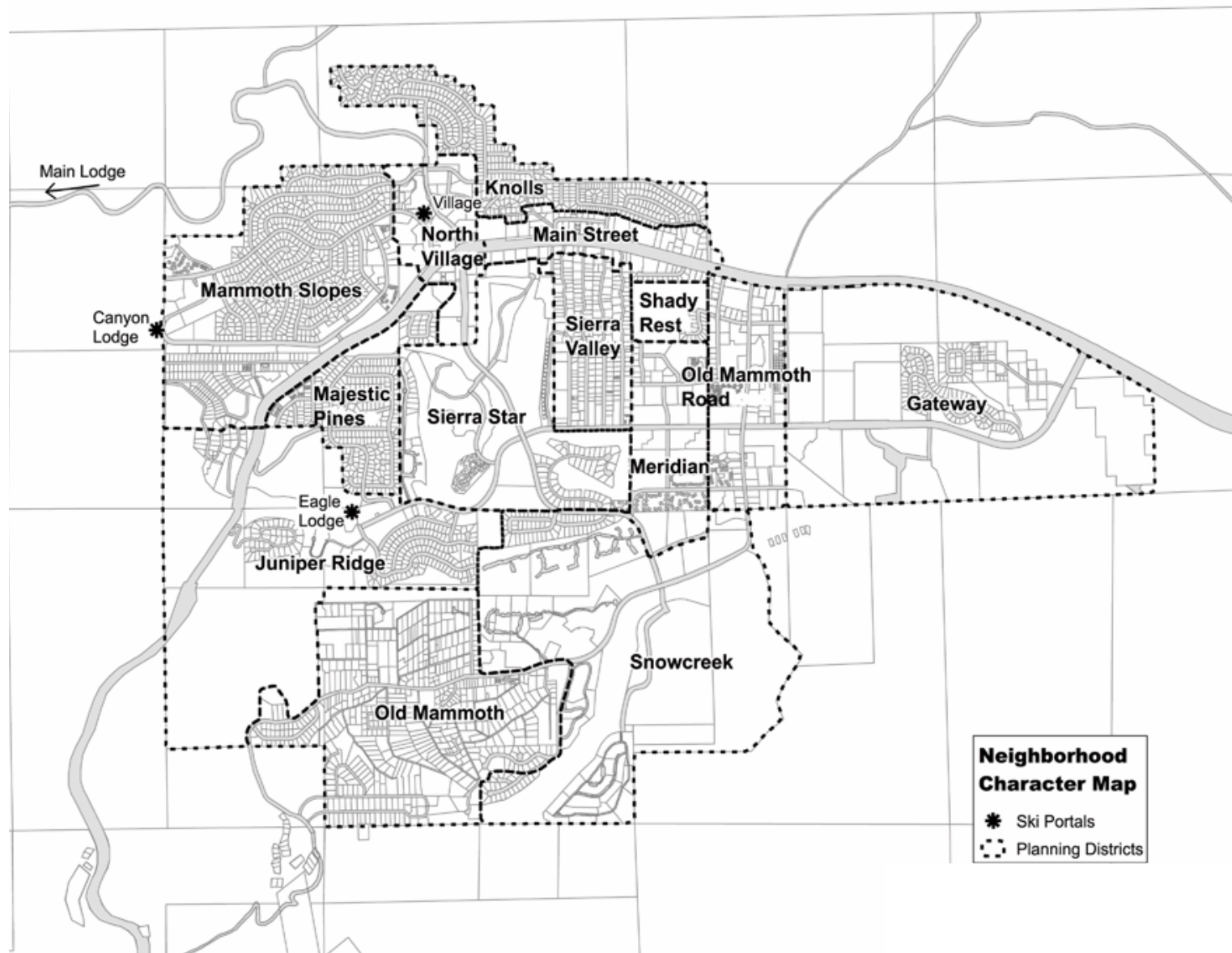


Figure II-4
LSC # 084870

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Town of Mammoth Lakes Neighborhood Districts
Mammoth Lakes Model Update

Figure II-5
LSC # 084870

Households and Population

Tables II-4 and II-5 show relevant sources of data for population and household characteristics within the Town of Mammoth Lakes. These sources contain information that was consolidated and updated for the final land use input table for the travel model. The Town of Mammoth Lakes has since gone through an extensive and comprehensive process to account for existing land uses and to estimate buildout and the associated population. These data were used as the basis for the update of the travel model. The tables below are preserved in this document to show continuity with prior work.

Population data show growth from 2000 to 2003, with a leveling or slight decline to 2008. Housing data, in contrast, show a continued increase in the number of dwelling units, amounting to 16 percent over eight years or 1.89 percent compounded average annual growth.

Table II-4 Population Growth Trends (1970-2008)				
Year	Population	Numerical Change	Average Annual Change	
			Number	Percent
1970	3,528			
1980	3,929	401	40.1	1.14%
1990	4,785	856	85.6	2.18%
2000	7,094	2,308	230.8	4.82%
2003	7,495	402	134	1.89%
2008	7,413	-82	-16	-0.32%
Sources: Census Bureau (2000 Census, SF3: P1) and (1990 Census, STF3: P1), DOF (Report E-5) as presented in the "Town of Mammoth Lakes Housing Element," December 2003; DOF & EDAW 2008 as presented in the "Town of Mammoth Lakes General Plan, Housing Element Draft," January 2009.				

Table II-5 Housing Units by Type (1990-2008)						
Housing Unit Type	1990		2000		2008	
	Number	Percent	Number	Percent	Number	Percent
Single-Family Detached	1,671	23.5%	2,122	26.7%	2,496	27%
Single-Family Attached	588	8.3%	965	12.1%	1,132	12.2%
2 Units	325	4.6%	301	3.8%	338	3.7%
3-4 Units	1,300	18.3%	1,239	15.6%	5,052	54.6%
5-9 Units	1,310	18.4%	1,169	14.7%		
10-19 Units	1,018	14.3%	749	9.4%		
20+ Units	655	9.2%	1,220	15.3%		
Mobile Homes, Etc.	235	3.3%	193	2.4%	227	2.5%
Total	7,102	100.0%	7,958	99.7%	9,245	100.0%
Sources: Census Bureau (2000 Census, SF 3: H30) and (1990 Census, SF: H20) as presented in the "Town of Mammoth Lakes Housing Element," December 2003; Claritas and EDAW, 2008 as presented in the "Town of Mammoth Lakes General Plan, Housing Element Draft," January 2009. The original data in the 2003 report separated out Mobile Homes from "Boat, RV, Van, Etc." and those data have been combined here.						

Employment

Tables II-6 and II-7 show employment data by industry for 2000 and 2008, respectively. The data are grouped in different categories and are therefore not directly comparable across all categories. The growth between the two years is roughly 800 employees, representing an annual average growth rate of 2.27 percent.

Table II-6 Employment by Industry - 2000		
Industry Type	2000	
	Number	Percent
Agriculture, Forestry, Fishing and Hunting, and Mining	40	0.9%
Construction	350	8.1%
Manufacturing	113	2.6%
Wholesale Trade	77	1.8%
Retail Trade	424	9.8%
Transportation and Warehousing, and Utilities	60	1.4%
Information	46	1.1%
Finance, Insurance, Real Estate and Rental and Leasing	166	10.8%
Professional, Scientific, Management, Administration	379	8.8%
Educational, Health and Social Services	482	11.2%
Arts, Entertainment, Recreation, and Services	1,598	37.1%
Other Services	117	2.7%
Public Administration	161	3.7%
Total	4,013	100%
Source: Census Bureau (2000 Census, SF3: P49 as presented in the "Town of Mammoth Lakes Housing Element," December 2003.		

Table II-7 Employment by Industry - 2008		
Industry Type	2008	
	Number	Percent
Management and Professional	1,662	34.6%
Service	1,229	25.6%
Sales and Office	1,046	21.8%
Farming, Fishing, and Forestry	4	0.1%
Construction, Extraction, and Maintenance	535	11.1%
Production, Transportation, and Material Moving	325	6.8%
Total	4,801	100.0%
Source: Claritas and EDAW, 2008 as presented in the "Town of Mammoth Lakes General Plan, Housing Element Draft," January 2009.		

Recreational

Table II-8 shows the estimated capacity of downhill skiers at one time (SAOT) at each of the four Mammoth Mountain portals. This information was provided by the Town of Mammoth Lakes and is based on the current capacity of Mammoth Mountain. As shown, a total of 24,000 downhill skiers are able to access the

mountain at one time. In addition, Table II-8 also shows the number of cross-country skiers at the Tamarack Lodge and Shady Rest Trail areas. Once again, this information was provided by the Town of Mammoth Lakes. As shown, a total of 350 cross-country skiers are estimated to visit these areas during a typical winter Saturday.

Table II-8 Skier Capacity Assumptions - 2009		
Ski Area	2009	
	Number	Percent
Downhill Skiers		
Main Lodge	8,000	33.3%
Canyon Lodge	8,000	33.3%
Eagle Lodge	4,000	16.7%
The North Village	4,000	16.7%
Total	24,000	100.0%
Cross-Country Skiers		
Tamarack Lodge Area	200	57.1%
Shady Rest Trails	150	42.9%
Total	350	100.0%
<i>Source: Town of Mammoth Lakes, January 2009.</i>		

Final Land Use Input Table

Table II-9 shows the final land use input table, which is used as the base data in the travel model—all 167 zones excluding the external station—aggregated. It is believed that these data are more recent and more accurate than the sources reviewed earlier in this chapter. Appendix A contains the disaggregated, zone-by-zone land use input information.

The number of dwelling units is the key input to the model and provides a more realistic representation of traffic and travel demand than using population as a base input. Use of population data would suggest little or no growth since 2000. Some data would show as much as 16 percent growth. The official 2009 estimate for dwelling units represents 8.8 percent growth over 2000 Census data, an intermediate estimate between the extremes. This finding indicates that at the level of trip generation, the first step of the model, input data may have as much as ±five percent variation.

Table II-9 Total Land Uses By Land Use Code (2009)			
Land Use Code	Description of Land Use	Units	Quantity
1	Residential Low Density (SF) - Resident	DUs	1,454
3	Residential High Density (MF) - Resident	DUs	4,023
4	Mobile Home Park - Resident	DUs	132
5	Residential Low Density (SF) - Visitor	DUs	627
7	Residential High Density (MF) - Visitor	DUs	2,426
10	Lodging (Hotel) - Visitor	Room	997
11	Resort Hotel - Visitor	Room	976
13	Retail/Commercial	KSF	1,305
21	Light Industrial	KSF	311
23	Public Utility	Acres	49
31	Public School	Acres	832
32	High School	Acres	314
33	College	Student	0
34	Hospital	Bed	21
36	Post Office	PRS	7,402
37	Church	Acres	14
39	Downhill Skiing-Employees	Employee	2,163
40	Downhill Skiing-Skiers	SAOT	24,000
41	Cross-Country Skiing/Snowmobiling	SAOT	350
Notes: DU = Dwelling Unit, KSF = Thousand Square Feet, PRS = postal receptacles (mailboxes), SAOT = skiers at one time.			
Source: Town of Mammoth Lakes, 2009			

One area to consider improving is the accounting of single-family versus multi-family dwelling units. Base information—both the Census and Housing Element data—shows 58 to 59 percent multi-family and 39 percent single-family, whereas data provided for the travel model are 74 percent multi-family and 24 percent single-family shares. The difference may be in how attached single-family units (i.e., duplexes and triplexes) are counted. All data sources agree on a two percent mobile home share.



CHAPTER III

Trip Generation

INTRODUCTION

Once all the input data are assembled, as described in the previous chapter, trip generation is the first step in the four-step model process. In this step, the land use input quantities are estimated to produce or attract a certain number of trips per unit of land use, per dwelling unit, per thousand square feet of retail space, or per employee. This chapter reviews how the land use quantities and trip rates are used to produce the total number of trips used in later steps of the model.

PRODUCTION AND ATTRACTION RATES

The Town of Mammoth Lakes provided the land use data by traffic analysis zone (TAZ) and land use type. Each land use category has a certain trip rate, defined to be the number of daily person-trips generated by every unit of land use within a TAZ. This trip rate varies by land use category.

There are 19 different land use types used in the Town of Mammoth Lakes transportation demand model. As compared to the 2005 model update, the following categories of land use were eliminated by combining them with other related categories: residential medium density - resident, residential medium density - visitor, retail/commercial and town offices measured in acres. Residential dwelling units are now classified as either low or high density, and all retail/commercial/office uses are now measured in thousands of square feet of floor space.

The same five trip purposes were used in the development of the 2009 model as were used in 2005. The five trip purposes are:

- Home-Based Recreation or “Home to Recreation” (H-REC)
- Home-Based Shopping or “Home to Shopping” (H-S)
- Home-Based Work or “Home to Work” (H-W)
- Home-Based Other or “Home to Other” (H-O)
- Other-to-Other (O-O)

Trip Generation

Table III-1 shows the trip rates associated with each of the 19 land use types. Also shown are the rate of trips by trip purpose and by whether they are a production or attraction. For example, if a low-density housing unit produces 12.80 trips per day, two of those trips are for shopping (2.048), more than two are for work (2.304), and four are for other trips from the home and so forth (4.096), for the rest of that line.

Table III-1 Daily Person-Trip End Production/Attraction Proportions by Trip Purpose														
Description	Unit	Land Use Code	Daily Person-Trip End Rate	Productions					Attractions					TOTAL
				H-REC	H-S	H-W	H-O	O-O	H-REC	H-S	H-W	H-O	O-O	
Residential Low Density (SF) - Resident	DUs	1	12.800	1.152	2.048	2.304	4.096	1.920	0.000	0.000	0.000	0.000	1.280	12.80
Residential High Density (MF) - Resident	DUs	3	8.100	0.891	1.458	1.539	2.511	0.729	0.000	0.000	0.000	0.000	0.972	8.10
Mobile Home Park - Resident	DUs	4	5.400	0.594	0.918	1.080	1.566	0.486	0.000	0.000	0.000	0.000	0.756	5.40
Residential Low Density (SF) - Visitor	DUs	5	14.000	4.620	3.220	0.000	3.080	1.960	0.000	0.000	0.000	0.000	1.120	14.00
Residential High Density (MF) - Visitor	DUs	7	11.500	3.795	2.645	0.000	2.530	1.610	0.000	0.000	0.000	0.000	0.920	11.50
Lodging (Hotel) - Visitor	Room	10	12.000	4.080	2.400	0.000	1.920	1.080	0.000	0.120	0.480	0.720	1.200	12.00
Resort Hotel - Visitor	Room	11	12.000	4.080	2.400	0.000	1.920	1.080	0.000	0.120	0.480	0.720	1.200	12.00
Retail/Commercial	KSF	13	60.200	0.000	0.000	0.000	0.000	8.729	6.923	15.351	3.010	20.167	6.020	60.20
Light Industrial	KSF	21	11.200	0.000	0.000	0.000	0.000	2.834	0.000	0.000	2.598	1.221	4.547	11.20
Public Utility	Acres	23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
Public School	Acres	31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
High School	Acres	32	1.270	1.000	0.000	0.000	0.000	0.020	0.000	0.000	0.006	0.224	0.019	1.27
College	Student	33	2.080	2.000	0.000	0.000	0.000	0.000	0.010	0.000	0.006	0.062	0.002	2.08
Hospital	Bed	34	17.000	3.000	0.000	0.000	0.000	3.220	0.000	0.000	1.456	6.216	3.108	17.00
Post Office	PRS	36	0.080	0.000	0.000	0.000	0.000	0.023	0.000	0.000	0.002	0.031	0.024	0.08
Church	Acres	37	140.000	0.000	0.000	0.000	0.000	29.540	0.000	0.000	0.000	61.320	49.140	140.00
Downhill Skiing-Employees	Employee	39	1.500	0.000	0.000	0.000	0.000	0.465	0.000	0.000	0.450	0.120	0.465	1.50
Downhill Skiing-Skiers	SAOT	40	1.600	0.000	0.000	0.000	0.000	0.000	1.408	0.000	0.000	0.032	0.160	1.60
Cross-Country Skiing/Snowmobiling	SAOT	41	1.900	0.000	0.000	0.000	0.000	0.000	1.653	0.000	0.076	0.019	0.152	1.90

Source: LSC, 2010.

Trip Generation

Table III-2 presents the number of trips by land use for both production and attraction totals, inclusive of trips from the external station at SR 203 near US 395. These are the raw, unbalanced result of applying the trip rates by TAZ, by land use, and by production/attraction, then adding the results together. The external stations comprised 29,402 daily person-trips of the total daily person-trip generation of 270,847 or about eleven percent of trips prior to trip balancing.

Table III-3 presents the number of trips by trip purpose for both production and attraction totals, inclusive of trips from the external station at SR 203 near US 395. These are the raw, unbalanced results of applying the trip rates by TAZ, by trip purpose, and by production/attraction, then adding the results together.

Table III-2 Unbalanced Daily Person Productions and Attractions by Land Use							
Description	Unit	Land Use Code	Quantity	Daily Person-Trip End Rate	Productions	Attractions	Total
Residential Low Density (SF) - Resident	DUs	1	1,454	12.80	16,750	1,861	18,611
Residential High Density (MF) - Resident	DUs	3	4,023	8.10	28,676	3,910	32,586
Mobile Home Park - Resident	DUs	4	132	5.40	613	100	713
Residential Low Density (SF) - Visitor	DUs	5	627	14.00	8,076	702	8,778
Residential High Density (MF) - Visitor	DUs	7	2,426	11.50	25,667	2,232	27,899
Lodging (Hotel) - Visitor	Room	10	997	12.00	9,452	2,512	11,964
Resort Hotel - Visitor	Room	11	976	12.00	9,252	2,460	11,712
Retail/Commercial	KSF	13	1,305	60.20	11,391	67,170	78,561
Light Industrial	KSF	21	311	11.20	881	2,602	3,483
Public Utility	Acres	23	49	0.00	0	0	0
Public School	Acres	31	832	0.00	0	0	0
High School	Acres	32	314	1.27	320	79	399
College	Student	33	0	2.08	0	0	0
Hospital	Bed	34	21	17.00	131	226	357
Post Office	PRS	36	7,402	0.08	169	423	592
Church	Acres	37	14	140.00	414	1,546	1,960
Downhill Skiing-Employees	Employee	39	2,163	1.50	1,006	2,239	3,245
Downhill Skiing-Skiers	SAOT	40	24,950	1.60	0	39,920	39,920
Cross-Country Skiing/Snowmobiling	SAOT	41	350	1.90	0	665	665
External Station at SR 203					26,412	2,990	29,402
Subtotal Without External Station					112,798	128,647	241,445
Totals With External Station					139,210	131,637	270,847
Source: LSC, 2010.							

**Table III-3
Unbalanced Daily Person Productions and Attractions by Trip Purpose**

Table III-3 Unbalanced Daily Person Productions and Attractions by Trip Purpose														
Description	Unit	Land Use Code	Quantity	Productions					Attractions					TOTAL
				H-REC	H-S	H-W	H-O	O-O	H-REC	H-S	H-W	H-O	O-O	
Residential Low Density (SF) - Resident	DUs	1	1,454	1,675	2,978	3,350	5,956	2,792	0	0	0	0	1,861	18,611
Residential High Density (MF) - Resident	DUs	3	4,023	3,584	5,866	6,191	10,102	2,933	0	0	0	0	3,910	32,586
Mobile Home Park - Resident	DUs	4	132	78	121	143	207	64	0	0	0	0	100	713
Residential Low Density (SF) - Visitor	DUs	5	627	2,897	2,019	0	1,931	1,229	0	0	0	0	702	8,778
Residential High Density (MF) - Visitor	DUs	7	2,426	9,207	6,417	0	6,138	3,906	0	0	0	0	2,232	27,899
Lodging (Hotel) - Visitor	Room	10	997	4,068	2,393	0	1,914	1,077	0	120	479	718	1,196	11,964
Resort Hotel - Visitor	Room	11	976	3,982	2,342	0	1,874	1,054	0	117	468	703	1,171	11,712
Retail/Commercial	KSF	13	1,305	0	0	0	0	11,391	9,035	20,033	3,928	26,318	7,856	78,561
Light Industrial	KSF	21	311	0	0	0	0	881	0	0	808	380	1,414	3,483
Public Utility	Acres	23	49	0	0	0	0	0	0	0	0	0	0	0
Public School	Acres	31	832	0	0	0	0	0	0	0	0	0	0	0
High School	Acres	32	314	314	0	0	0	6	0	0	2	70	6	399
College	Student	33	0	0	0	0	0	0	0	0	0	0	0	0
Hospital	Bed	34	21	63	0	0	0	68	0	0	31	131	65	357
Post Office	PRS	36	7,402	0	0	0	0	169	0	0	17	231	175	592
Church	Acres	37	14	0	0	0	0	414	0	0	0	858	688	1,960
Downhill Skiing-Employees	Employee	39	2,163	0	0	0	0	1,006	0	0	973	260	1,006	3,245
Downhill Skiing-Skiers	SAOT	40	24,950	0	0	0	0	0	35,130	0	0	798	3,992	39,920
Cross-Country Skiing/Snowmobiling	SAOT	41	350	0	0	0	0	0	579	0	27	7	53	665
Totals				25,868	22,135	9,684	28,121	26,989	44,743	20,270	6,733	30,473	26,429	241,445
				112,798					128,647					
Source: LSC, 2010.														

Table III-4 shows the results by trip purpose after trip balancing has been completed. Balancing was performed by holding attractions for home-based recreation and home-based shopping trips, holding productions for home-based work trips, and averaging productions and attractions for home-based other and other-to-other trips. The greatest number of trips are generated as home-based recreation trips. In fact, 95,324 daily person home-based recreation trips were generated out of the 268,930 total trips, which equates to 35 percent of the total trip generation. The next greatest trip purpose was home-based other for which 59,124 daily person-trips were generated. The smallest portion of trips were home-based work trips, which comprised seven percent of the total daily person-trips generated by the model area. These totals include external station trip production and attraction from locations at SR 203 near US Highway 395. The trip purpose totals represent the person-trip travel volumes for travel to and from the TAZs within the Town of Mammoth Lakes on a typical winter Saturday.

Table III-4			
Balanced Daily Person Productions and Attractions by Trip Purpose			
Description	Productions	Attractions	Total
Home-Based Recreation	47,662	47,662	95,324
Home-Based Shopping	20,270	20,270	40,540
Home-Based Work	9,999	9,999	19,998
Home-Based Other	29,562	29,562	59,124
Other-to-Other	26,972	26,972	53,944
Total			268,930
<i>Notes: From balanced.bin file. Includes 240,290 from land uses and 28,640 from external station volumes.</i> <i>Source: LSC 2010.</i>			

Table III-5 presents a comparison of trip rate changes from the 2005 model. Some of the land use categories saw no change in trip rates between 2005 and 2009. For most land use categories, the recommended changes in trip rates were more notable, with a reduction of 20-30 percent in some.

**Table III-5
Trip Rate Changes from 2005 to 2009 Model**

Land Use Code	Description	2005		2009		Reason for Change from 2005
		Rate	Units	Rate	Units	
1	Residential Low Density (SF) - Resident	19.00	DUs	12.80	DUs	Reduced 19.00 by 12% to reflect over-prediction of residential trips. Additional 25% reduction based on new calibration targets.
3	Residential High Density (MF) - Resident	12.00	DUs	8.10	DUs	Reduced 19.00 by 12% to reflect over-prediction of residential trips. Additional 25% reduction based on new calibration targets.
4	Mobile Home Park - Resident	7.00	DUs	5.40	DUs	25% reduction based on new calibration targets.
5	Residential Low Density (SF) - Visitor	21.00	DUs	14.00	DUs	Reduced 19.00 by 12% to reflect over-prediction of residential trips. Additional 25% reduction based on new calibration targets.
7	Residential High Density (MF) - Visitor	17.00	DUs	11.50	DUs	Reduced 19.00 by 12% to reflect over-prediction of residential trips. Additional 25% reduction based on new calibration targets.
10	Lodging (Hotel) - Visitor	16.00	Room	12.00	Room	25% reduction based on new calibration targets.
11	Resort Hotel - Visitor	16.00	Room	12.00	Room	25% reduction based on new calibration targets.
13	Retail/Commercial	78.71	KSF	60.20	KSF	Changes in Floor Area Ratio (FAR) assumptions and 25% reduction based on new calibration targets.
21	Light Industrial	14.60	Acres	11.20	KSF	Units were incorrect in 2005 table. KSF is correct for both 2005 and 2009. Change in FAR assumptions and 25% reduction.
23	Public Utility	0.00	Acres	0.00	Acres	No change.
31	Public School	71.00	Acres	0.00	Acres	School is not in session on Saturdays. 2009 model is a Saturday model.
32	High School	71.00	Acres	1.27	Acres	School is not in session on Saturdays. Some high school events still occur on Saturdays, so not taken to zero. 2009 model is a Saturday model.
33	College	76.00	Student	2.08	Student	2005 model had college employees and dorms in the same TAZ. Dorm trips are now represented as residential high density.
34	Hospital	18.00	Bed	17.00	Bed	Minor adjustment to reflect new calibration targets.
36	Post Office	0.50	PRS	0.08	PRS	7,400 postal boxes. New rate more indicative of a Saturday. Prior rate more indicative of weekday conditions.
37	Church	182.00	Acres	140.00	Acres	25% reduction based on new calibration targets.
39	Downhill Skiing-Employees	6.10	Employee	1.50	Employee	6.10 represented all ski-related trips against the number of employees. 2.00 represents only employees.
40	Downhill Skiing-Skiers	2.30	SAOT	1.60	SAOT	25% reduction based on new calibration targets.
41	Cross-Country Skiing/Snowmobiling	2.50	SAOT	1.90	SAOT	25% reduction based on new calibration targets.

Source: LSC and Town of Mammoth Lakes, 2010.

TRIP GENERATION VALIDATION

The information discussed above provides the foundation for the modeling process. Although there has been significant review and analysis of the input data (land use types by TAZ) provided by the Town of Mammoth, many of the trip rates had been carried over from 1997 to 2005 and then to this 2009 model. Given the many changes throughout the creation of this model in TransCAD, it was felt that additional effort was warranted to further validate this step in the modeling process to provide additional reassurance that the final output traffic and transit assignment volumes were as accurate as possible.

Home-Based Trips

A comparison was made to Institute of Transportation Engineers (ITE) trip rates to confirm that a similar number of trips are produced by different methods. The comparison includes all residential dwelling unit categories for all trip types, whether to recreation, shopping, work, or other. The comparison was made with the unbalanced trips. The comparison does not include trips generated at a non-residential location. Table III-6 presents the results of this comparison, concluding that by different methods, the total number of estimated trips is within two percent with ITE rates predicting 87,000 trips (rounded) and the model predicting 88,600 (rounded). This is considered a very good match.

A second comparison was made to National Highway Cooperative Research Program (NCHRP) data available in the *NCHRP 365 Travel Estimation Techniques for Urban Planning* publication. Tables III-7 through III-9 look at the following comparisons:

- Households by Vehicle Availability
- Households by Household Size
- Households by Income

Based on these data, the NCHRP data suggest a range of 73,300 to 82,700 trips for home-based trip purposes, with a midpoint of 78,000 (rounded). At 88,600 the travel model is within 14 percent of the midpoint of that range. This is also a good finding.

Table III-6
Residential Trip Generation Validation Using ITE Trip Rates

Land Use Code	Description of Land Use	Units	Quantity¹	ITE Trip Generation Rate (Vehicle-Trips)²	Average Auto Occupancy³	Person-Trips Based on ITE Vehicle and AAO (Qty x Rate x AAO)
1	Residential Low Density (SF) - Resident	DUs	1,454	9.57	1.49	20,733
3	Residential High Density (MF) - Resident	DUs	4,023	5.86	1.49	35,126
4	Mobile Home Park - Resident	DUs	132	4.99	1.49	981
5	Residential Low Density (SF) - Visitor	DUs	627	9.57	1.49	8,941
7	Residential High Density (MF) - Visitor	DUs	2,426	5.86	1.49	21,182
	ITE Trip Rate Totals for These Land Uses		8,662			86,964
	Model Totals for These Land Uses		8,662			88,587
Notes: HBW = home-based work, HBO = home-based other, HBS = home-based shopping, DUs = Dwelling Units.						
Sources: ¹ Town of Mammoth Lakes, 2009; ² Institute of Transportation Engineers, "Trip Generation Manual, 7th Edition," 2003; ³ NCHRP 365, Table 37, all trip purposes, 1998; LSC, 2010.						

Table III-7 Trip Generation Estimate Based On the Number of Households and Vehicle Availability (excludes Ski Trips)			
Household Vehicle Availability (Occupied Housing Units)	Number of Households¹	Person-Trips Per Household Based on Vehicles²	Person-Trips Generated
0 Vehicles Available	146	3.9	569
1 Vehicles Available	1,112	6.3	7,006
2 Vehicles Available	1,159	10.6	12,285
3+ Vehicles Available	398	13.2	5,254
Total in 2000	2,815		25,114
Rate to convert from Occupied to Total Housing Units on a Typical Weekend ³			2.827
Rate to convert from 2000 to 2009 Total Housing Units ⁴			1.088
Total 2009 Person-Trips Generated			77,278
<i>Sources: ¹US Census Bureau. Census 2000, SF 3, Table H44.</i> <i>²NCHRP 365, Table 6.</i> <i>³7,958 total / 2,815 occupied (Census 2000, SF 3, Table H6).</i> <i>⁴8,662 (Town of Mammoth Lakes 2009) / 7,958 (Census 2000).</i>			

Table III-8 Trip Generation Estimate Based On the Number of Households and Household Size (excludes Ski Trips)			
Household Size (Occupied Housing Units)	Number of Households¹	Person-Trips Per Household Based on Size²	Person-Trips Generated
1-Person Household	805	3.7	2,979
2-Person Household	1,005	7.6	7,638
3-Person Household	408	10.6	4,325
4-Person Household	341	13.6	4,638
5+ Person Household	256	16.6	4,250
Total in 2000	2,815		23,829
Rate to convert from Occupied to Total Housing Units on a Typical Weekend ³			2.827
Rate to convert from 2000 to 2009 Total Housing Units ⁴			1.088
Total 2009 Person-Trips Generated			73,322
<i>Sources: ¹US Census Bureau. Census 2000, SF 3, Table H16.</i> <i>²NCHRP 365, Table 6.</i> <i>³7,958 total / 2,815 occupied (Census 2000, SF 3, Table H6).</i> <i>⁴8,662 (Town of Mammoth Lakes 2009) / 7,958 (Census 2000).</i>			

Table III-9 Trip Generation Estimate Based On the Number of Households by Income (excludes Ski Trips)			
Household Vehicle Availability (Occupied Housing Units)	Number of Households¹	Person-Trips Per Household Based on Vehicles²	Person-Trips Generated
Low (<15,000)	304	6.0	1,824
Medium (15,000-89,999)	2,052	9.3	19,086
High (90,000+)	471	12.7	5,979
Total in 2000	2,827		26,888
Rate to convert from Occupied to Total Housing Units on a Typical Weekend ³			2.827
Rate to convert from 2000 to 2009 Total Housing Units ⁴			1.088
Total 2009 Person-Trips Generated			82,738
Sources: ¹ US Census Bureau. Census 2000, SF 3, Table P52 and LSC 2009. ² NCHRP 365, Table 5. ³ 7,958 total / 2,815 occupied (Census 2000, SF 3, Table H6). ⁴ 8,662 (Town of Mammoth Lakes 2009) / 7,958 (Census 2000).			

Non-Home-Based Trips

A similar comparison was made for non-home-based (non-residential) trip types. The ITE *Trip Generation Manual* does not contain trip rates for all categories of trips unique to the Town of Mammoth Lakes, so a comparison was made only for those land uses and trip categories for which data were available. Table III-10 presents the results of the non-home-based trip generation comparison. The results are within 20 percent, which is reasonable.

Table III-10 Non-Residential Generation Validation Using ITE Trip Rates						
Land Use Code	Description of Land Use	Units	Quantity¹	ITE Trip Generation Rate (Vehicle-Trips)²	Average Auto Occupancy³	Person-Trips Based on ITE Vehicle and AAO (Qty x Rate x AAO)
10	Lodging (Hotel) - Visitor	Room	997	8.17	2.1	17,106
11	Resort Hotel - Visitor	Room	976	8.17	2.1	16,745
13	Retail/Commercial	KSF	1,305	42.94	1.7	95,262
21	Light Industrial	KSF	311	6.97	1.6	3,468
	ITE Trip Rate Totals for These Land Uses					132,581
	Model Totals for These Land Uses					105,720
Notes: DU = Dwelling Unit, KSF = Thousand Square Feet, PRS = postal receptacles (mailboxes), SAOT = skiers at one time.						
Sources: ¹ Town of Mammoth Lakes, 2009; ² Institute of Transportation Engineers, "Trip Generation Manual, 7th Edition," 2003; ³ Model Validation and Reasonableness Checking Manual, Table 5-5, 2001; LSC, 2009.						



CHAPTER IV

Trip Distribution

INTRODUCTION

Trip distribution is the second major step in the travel model. It answers the “where” question with regard to trip-making. Once a person decides that a trip is needed to satisfy some purpose, a choice among many possible destinations that might meet that purpose must be made and this decision is represented in the travel model.

TRIP DISTRIBUTION THEORY

The representation of the location decision is based on Newton’s model of gravity, which says the attractiveness of two objects is related to the size of the objects and inversely-related to the squared distance between them. In simpler terms and relating it to trip-making, an individual prefers a shorter trip if all else is equal, but will balance the prospect of a shorter-trip with knowledge that some destinations may serve the trip purpose better than others even if they are farther away.

In trip-making choices, it is not only the distance that individuals respond to, but also travel time. Two equal choices for a product or service (e.g., the same chain store) might be an equal distance away, but the perceived attractiveness of the destinations can be affected by a number of factors. Examples of equal chain store choices being affected by the travel time include:

- One location is served by a higher-speed arterial street and the other a lower-speed residential street (a.k.a. link speeds).
- One location is on a street that is always congested and the other is not.
- One location may have a parking cost (i.e., parking meter or pay lot) and the other does not.
- One may have a bus stop nearer than the other.

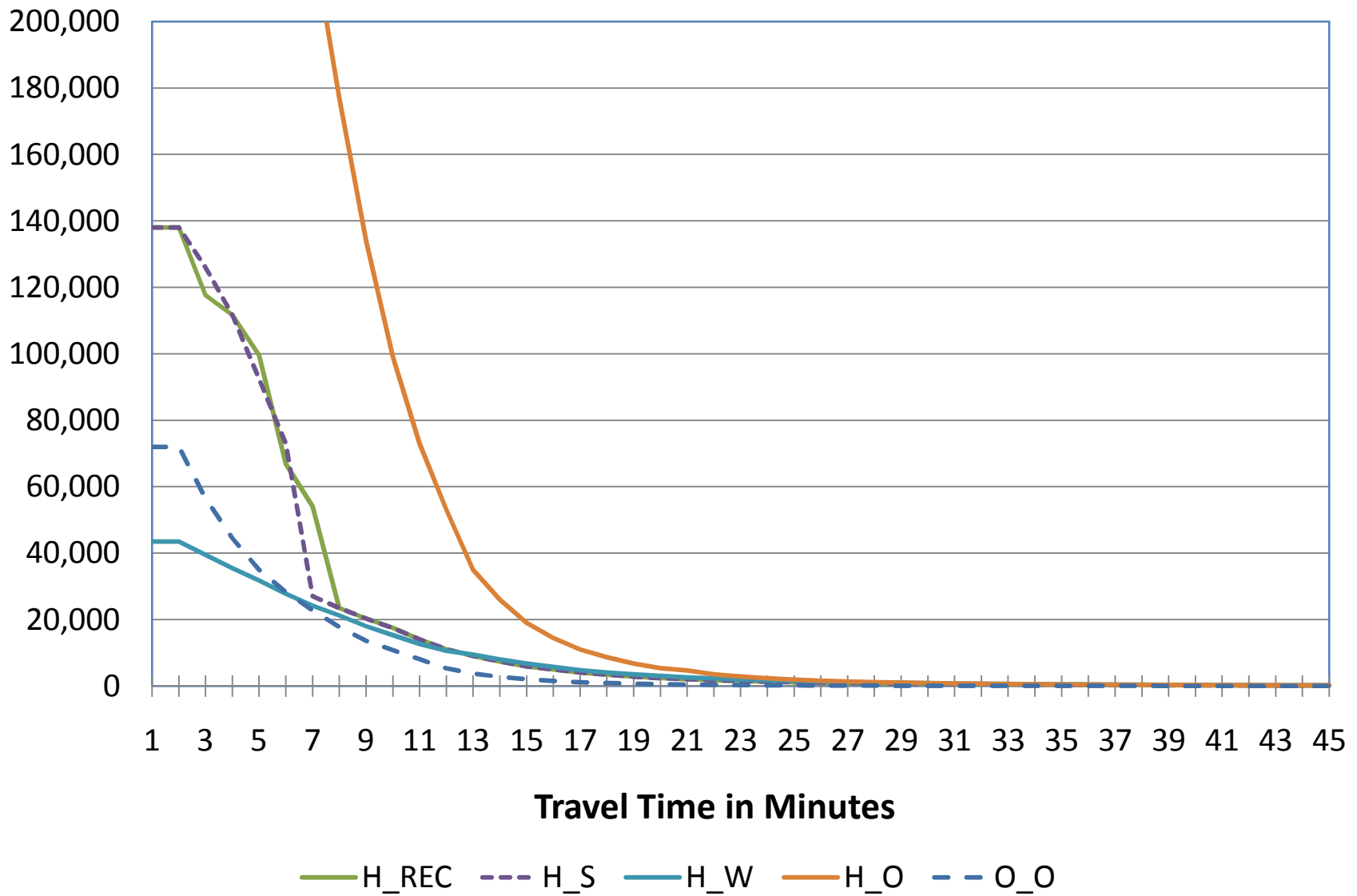
The total of these travel time increments or “impedances” is compared in the model.

FRICTION FACTORS

Friction factors are sets of numbers in the modeling process that help to describe the sensitivity of travelers to the total impedance by trip purpose. Many errands individuals run, for example, occur at non-congested times of day and therefore may be less sensitive to travel distance and travel time. Trips to work, on the other hand, are more sensitive to congestion and delay as individuals need to arrive on time reliably.

Friction factors for this model were adapted from the 2005 model and are shown in Figure IV-1. In this chart on the vertical axis, the higher the number, the lower the sensitivity. Looking at the solid line labeled H-O for home-based other or home to other, it does not become sensitive to travel time until about the ten-minute mark where it touches the top of the chart. This chart is intended to communicate the relative sensitivity among trip purposes.

**Figure IV-1
Friction Factor Curves**

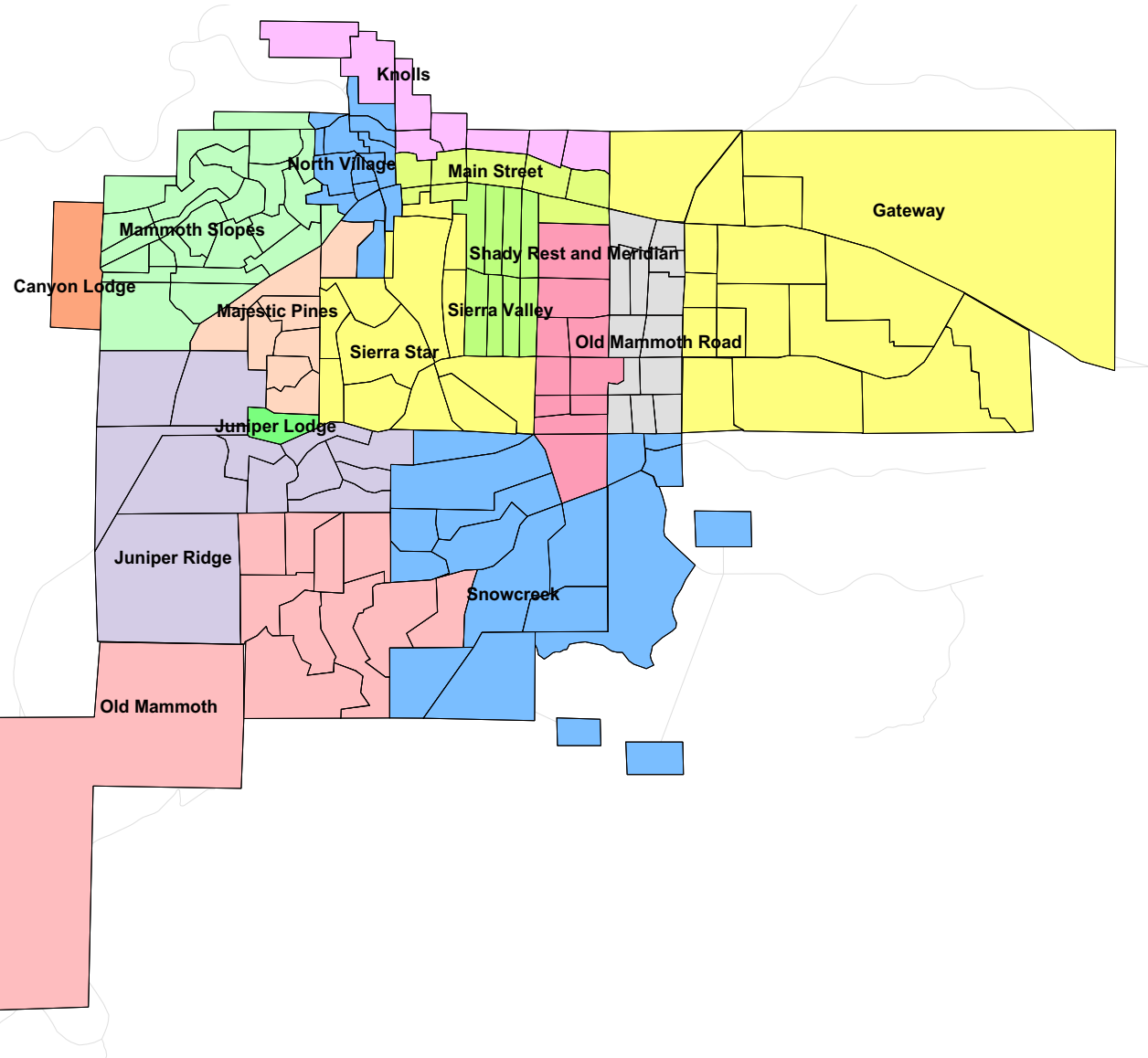


K-FACTORS

K-factors or “socioeconomic adjustment factors” are applied when all other impedance variables, after adjustments, still do not produce satisfactory results for some geographic subarea of the travel model.

K-factors are used in the Town of Mammoth Lakes travel model for the Mammoth Slopes neighborhood area surrounding the Canyon Lodge. Figure IV-2 shows the districts used in the modeling process, consistent with the neighborhood boundaries and ski portals.

Table IV-1 presents the adjustment results showing the results with and without a K-factor. The original raw results had 40 percent of residents in the Mammoth Slopes neighborhood using the Canyon Lodge ski area portal, despite that being the nearest place to access the mountain. Half of Mammoth Slopes residents were originally forecast to make a longer trip to the Main Lodge to access the mountain. When carried through the model, this resulted in inordinately high traffic volumes leaving the neighborhood via the Forest Trail and Minaret roadways. After adjustments were made, Mammoth Slopes residents are more likely to access the mountain at Canyon Lodge than either of the other lodge/portal base areas.



Town of Mammoth Lakes
Neighborhood Districts
Mammoth Lakes Model Update

Figure IV-2
LSC # 084870

Table IV-1 Mammoth Slopes K-Factor Adjustment Results												
Mammoth Slopes TAZ	Original Raw Results						Corrected Results					
	Main Lodge TAZ 1		Canyon TAZ 42		Eagle TAZ 130		Main Lodge TAZ 1		Canyon TAZ 42		Eagle TAZ 130	
	Trips	%	Trips	%	Trips	%	Trips	%	Trips	%	Trips	%
6	73	56%	47	36%	11	8%	57	39%	84	57%	5	4%
14	78	52%	58	39%	12	9%	61	37%	99	60%	6	3%
15	52	53%	39	39%	8	8%	41	37%	65	59%	4	4%
16	66	54%	46	37%	12	9%	50	36%	83	60%	6	4%
17	43	56%	27	36%	6	8%	36	43%	45	54%	3	3%
21	293	50%	233	40%	62	10%	195	28%	469	68%	25	4%
22	110	52%	83	39%	18	9%	85	36%	144	61%	9	3%
23	305	49%	258	41%	63	10%	205	28%	498	68%	26	4%
24	60	53%	45	39%	9	8%	48	38%	73	58%	4	4%
25	47	52%	35	39%	9	9%	37	36%	62	60%	4	4%
26	56	51%	42	39%	11	10%	43	35%	76	61%	5	4%
27	198	50%	153	39%	41	11%	144	31%	295	65%	18	4%
43	82	47%	76	43%	19	10%	86	50%	69	40%	17	10%
44	143	46%	133	43%	34	11%	93	25%	259	71%	13	4%
45	23	49%	19	41%	5	10%	16	31%	34	65%	2	4%
46	37	48%	33	42%	8	10%	28	32%	56	64%	4	4%
47	72	52%	55	39%	12	9%	56	36%	93	60%	6	4%
48	94	52%	70	39%	16	9%	77	39%	114	57%	8	4%
49	59	53%	43	39%	8	8%	49	41%	68	56%	4	3%
50	272	49%	215	39%	63	12%	187	29%	437	67%	27	4%
51	65	53%	45	37%	12	10%	48	34%	87	62%	5	4%
57	82	47%	74	42%	19	11%	58	29%	136	67%	8	4%
58	175	49%	146	41%	38	10%	122	30%	274	66%	16	4%
95	204	48%	185	43%	39	9%	157	33%	306	64%	18	3%
96	189	50%	147	39%	40	11%	136	32%	279	65%	17	3%
Total	2,878	50%	2,308	40%	573	10%	2,115	32%	4,204	64%	261	4%
Source: Trip Distribution.mtx files from TransCAD modeling. Excerpted by LSC, 2010.												

TRIP DISTRIBUTION RESULTS

The results of the trip distribution step are a table or matrix of 170 rows and 170 columns (or 167 x 167 without the external zones). This table is used by the model in subsequent steps. To digest the results more easily, the results were distilled into a 17-row and 17-column district table—Table IV-2—using the neighborhood districts previously mentioned in this report. Each district represents a collection of individual TAZs.

The grey-highlighted cells diagonally across the table show trips that both begin and end in the same district. Row totals show how many trips are from each district while column totals show how many person-trips are destined to each district. As an example, there are 4,001 person-trips from the Main Lodge going to other places while other places are sending 26,269 person-trips to the Main Lodge on a daily basis.

The largest trip-interchanges are between the following pairs (listed in “from” to “to” order):

- Main Lodge to Main Lodge (3.0%)
- Mammoth Slopes to Canyon Lodge (3.1%)
- Mammoth Slopes to Old Mammoth Road (4.5%)
- Shady Rest/Meridian to Old Mammoth Road (3.2%)
- Old Mammoth Road to Old Mammoth Road (3.2%)
- Juniper Ridge to Old Mammoth Road (2.9%)
- External Stations to Main Lodge (6.1%)
- External Stations to Canyon Lodge (3.7%)

Table IV-2 Saturday District-to-District Person-Trip Distribution Results																			
DISTRICT		Destinations																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL
Origins	1	3,993	1	0	1	1	0	1	0	0	0	0	2	0	0	0	0	0	4,001
	2	0	1,123	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1,126
	3	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29
	4	2,115	4,204	261	302	1,284	61	2,142	84	30	318	199	6,069	533	291	165	566	87	18,714
	5	1,178	707	266	124	1,941	26	622	35	14	103	91	1,960	151	100	76	212	116	7,722
	6	646	380	87	73	354	15	521	18	8	80	54	1,554	165	67	44	143	37	4,246
	7	1,174	759	289	256	716	55	786	70	28	160	183	2,373	304	164	121	287	125	7,848
	8	792	548	149	85	429	15	627	24	9	93	60	1,856	174	94	59	177	53	5,243
	9	396	255	98	33	201	7	260	10	4	39	28	826	68	35	28	90	38	2,417
	10	882	567	160	88	485	19	707	24	10	105	72	2,182	242	96	66	229	64	5,998
	11	1,785	1,159	381	140	907	32	1,375	41	18	201	134	4,287	441	170	134	494	171	11,871
	12	1,678	1,137	472	620	1,096	146	1,485	178	80	365	495	4,308	778	403	324	689	173	14,426
	13	386	247	100	87	205	22	329	25	12	68	90	992	181	65	49	120	42	3,021
	14	1,133	790	1,156	125	584	25	938	39	15	145	105	3,009	251	132	90	316	86	8,941
	15	824	567	162	66	348	15	585	20	10	88	77	2,081	196	79	78	263	65	5,522
	16	1,080	742	230	110	511	25	834	32	17	128	125	2,881	285	120	104	368	95	7,687
	17	8,208	4,942	2,489	33	2,553	8	1,036	9	4	117	33	3,543	275	69	184	317	1,834	25,655
TOTAL		26,269	18,128	6,328	2,143	11,619	471	12,248	610	259	2,011	1,746	37,924	4,045	1,885	1,523	4,270	2,985	134,465
District Key 1. Main Lodge 2. Canyon Lodge 3. Eagle Lodge 4. Mammoth Slopes 5. North Village 6. Knolls 7. Main Street 8. Majestic Pines 9. Sierra Star 10. Sierra Valley 11. Shady Rest / Meridian 12. Old Mammoth Road 13. Gateway 14. Juniper Ridge 15. Old Mammoth 16. Snowcreek 17. Externals																			
Source: Trip Distribution.mtx aggregated using area_aggregate_tables_extnl.bin. LSC, 2010.																			

Trip Length Frequency Distributions by Trip Purpose

Figure IV-3 shows the trip length frequency distribution for the five trip purposes. This chart is intended to communicate that the highest number of trips are about three minutes in duration and that trips of over 10 minutes are rare, except recreation trips.

Validation of trip distribution is usually done, in part, by comparing household travel survey information on trip times to modeled trip times. Comprehensive data are not available in this regard. Census data do exist to validate the home-based work trip purpose with the caveat that Census data generally represent weekday commuting times, whereas this model is attempting to represent Saturday work trip times.

**Figure IV-3
 Trip Length Frequency Distribution**

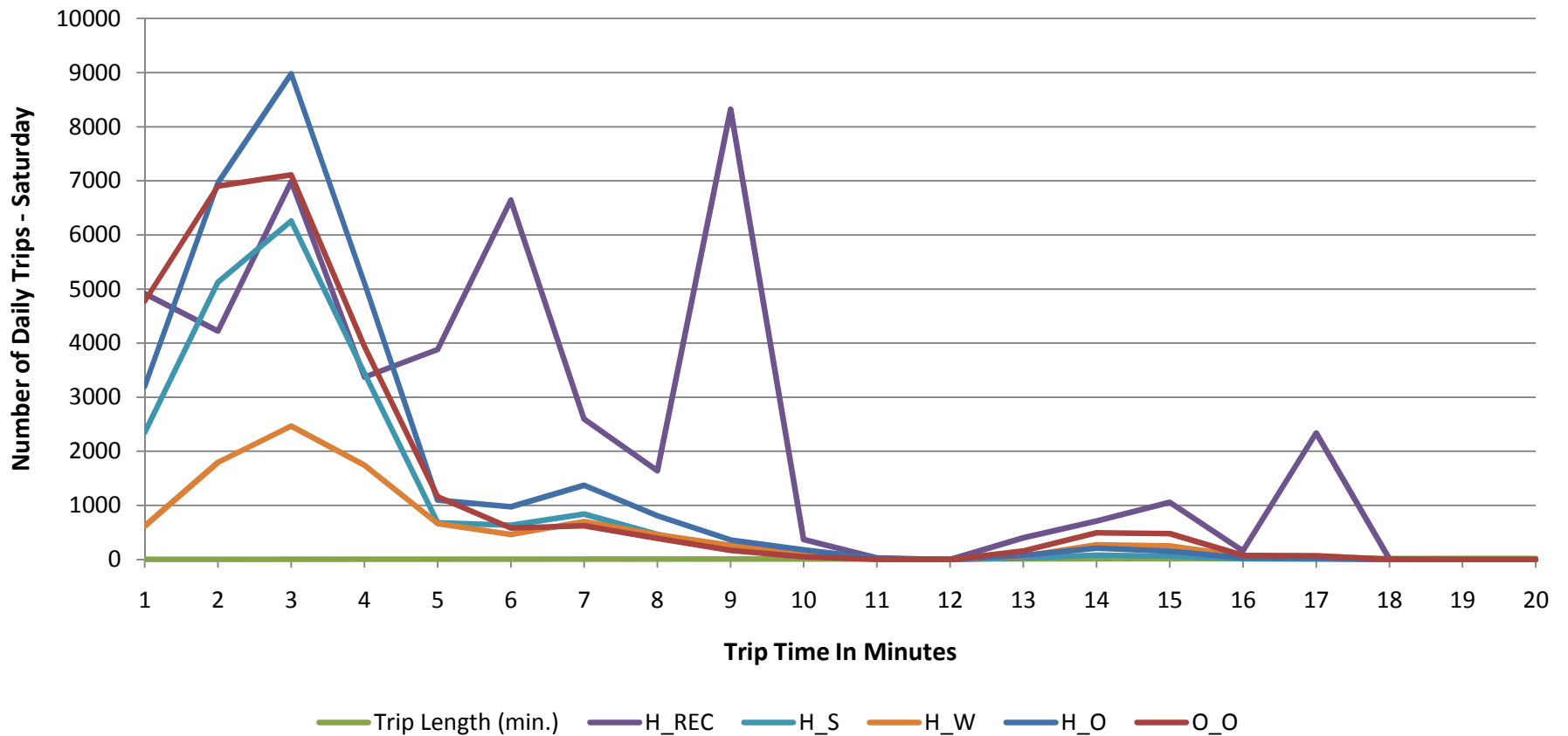
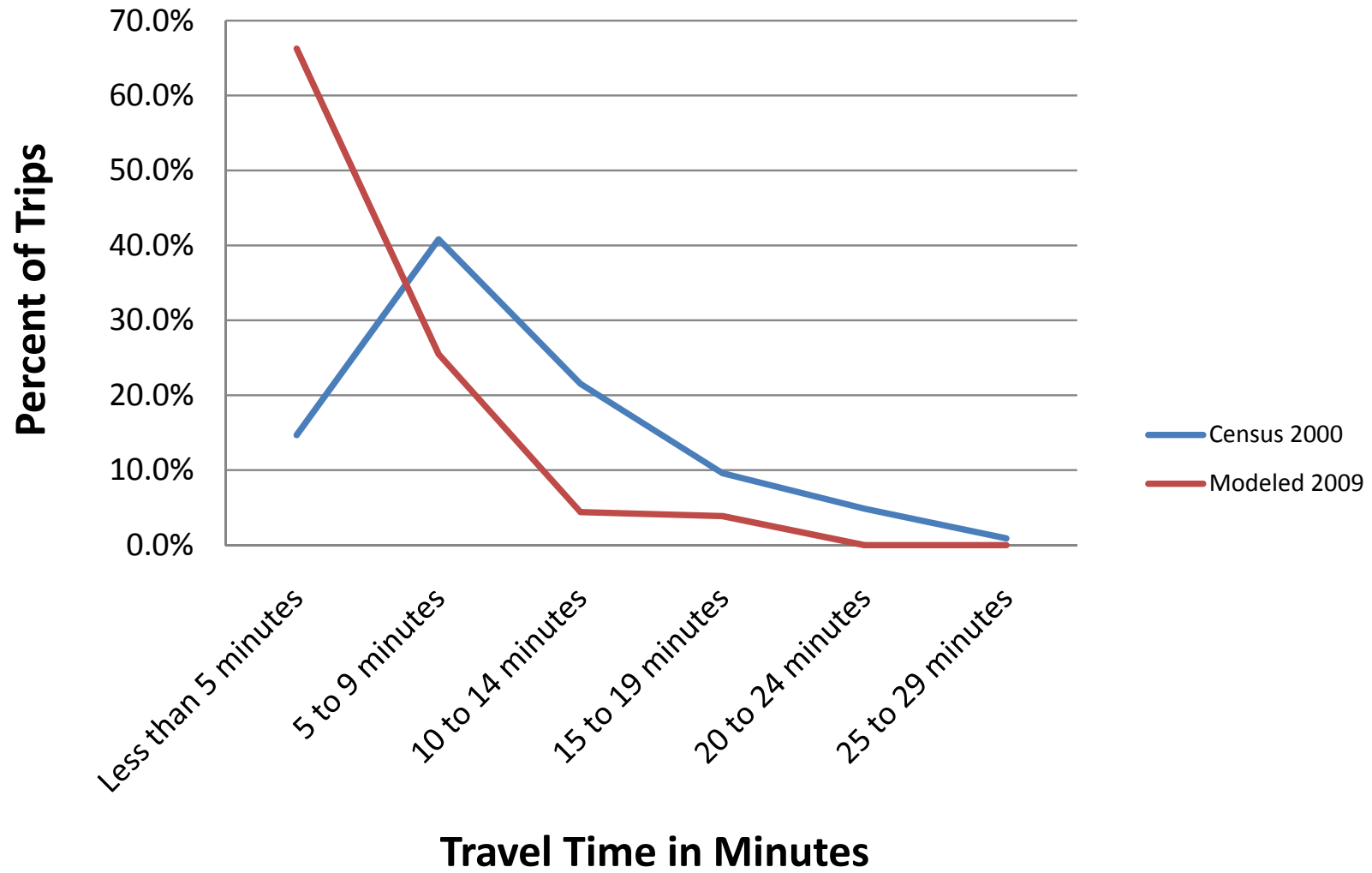


Table IV-3 presents the available data from the Census and from model outputs. At a gross level, both actual and modeled data show in excess of 90 percent of work trips taking less than 24 minutes to complete. There is consistency on this point. Figure IV-4 shows the trip length frequency distribution visually. From this chart, the shape of the curves are similar, indicating reasonable results.

Table IV-3			
Travel Time to Work Trip Length Validation			
Travel Time	Census 2000, Weekday (Persons)		Saturday Modeled
	Number	Percentage	Percentage
Less than 5 minutes	573	14.7%	66.3%
5 to 9 minutes	1,593	40.8%	25.5%
10 to 14 minutes	840	21.5%	4.4%
15 to 19 minutes	375	9.6%	3.9%
20 to 24 minutes	190	4.9%	0.0%
25 to 29 minutes	35	0.9%	0.0%
30 to 34 minutes	105	2.7%	0.0%
35 to 39 minutes	0	0.0%	0.0%
40 to 44 minutes	17	0.4%	0.0%
45 to 59 minutes	102	2.6%	0.0%
60 to 89 minutes	0	0.0%	0.0%
90 or more minutes	74	1.9%	0.0%
Did not work at home	3,904	100.0%	100.0%
Worked at home	323	n/a	n/a
Total	4,227	n/a	n/a
Source: US Census Bureau, 2000 Census, SF3: Table P31. LSC, 2010.			

Figure IV-4
HBW Trip Length Frequency Distribution



Recreation Trip Distribution Results

As noted in the chapter on trip generation, recreation trips represent 35 percent of peak Saturday trip making in the Town of Mammoth Lakes. Not only do recreation trips represent a large proportion of all Saturday trips, but their geographic distribution is primarily to four locations. It is therefore important to look at validating the results of the trip distribution for recreation trips.

Table IV-4 presents the results of the modeled versus the current trip distribution for recreation trips. Estimates of current skier totals provided by the Town of Mammoth Lakes suggest a percentage distribution of skiers of 33/33/17/17 at the Main Lodge, Canyon Lodge, Eagle Lodge, and North Village, respectively. This distribution is only for skiers and does not include employees, lodge area shopping, or other associated trips.

Modeled percentage recreation trips are distributed 41/30/15/14 at Main Lodge, Canyon Lodge, Eagle Lodge, and North Village, respectively. Like the actual data, these data are for skiers only. These modeled results are within three percent for Canyon Lodge, Eagle Lodge, and North Village, and are within eight percent for the Main Lodge, so are considered to be within expected model tolerances.

Table IV-4 Ski Lodge / Portal Distribution Results (H-REC Trip Purpose)						
		Lodge / Portal Destinations				
		Main Lodge TAZ 1	Canyon Lodge TAZ 42	Eagle Lodge TAZ 130	North Village TAZ 28	Total
Internal Origins	Trips	7,025	6,350	3,017	2,962	19,353
External Origins	Trips	8,049	4,834	2,475	2,247	17,605
Modeled Total ¹	#	15,073	11,184	5,491	5,209	36,958
	%	40.8%	30.3%	14.9%	14.1%	100.0%
Current Skier Estimates, Including Employees ²	%	33.3%	33.3%	16.7%	16.7%	83.3%
Sources: ¹ LSC (modeled) and ² Town of Mammoth Lakes (estimates of actual utilization), 2010.						

Figures IV-5, IV-6, IV-7, and IV-8 visually display the origin location of trips attracted to the Main Lodge, Canyon Lodge, Eagle Lodge, and North Village,

Trip Distribution

respectively. Trips attracted to the Main Lodge come primarily from the SR 203 external, and the following neighborhood districts: Old Mammoth Road, Meridian, North Village and Main Street areas. Trips attracted to the Canyon Lodge come primarily from the SR 203 external node, and the Mammoth Slopes neighborhood district. Trips attracted to the Eagle Lodge come primarily from the SR 203 external node and the following neighborhood districts: Juniper Ridge, Main Street, Meridian, and Snowcreek. Trips attracted to the North Village come primarily from the SR 203 external, and the North Village, Main Street, and Old Mammoth neighborhood districts.

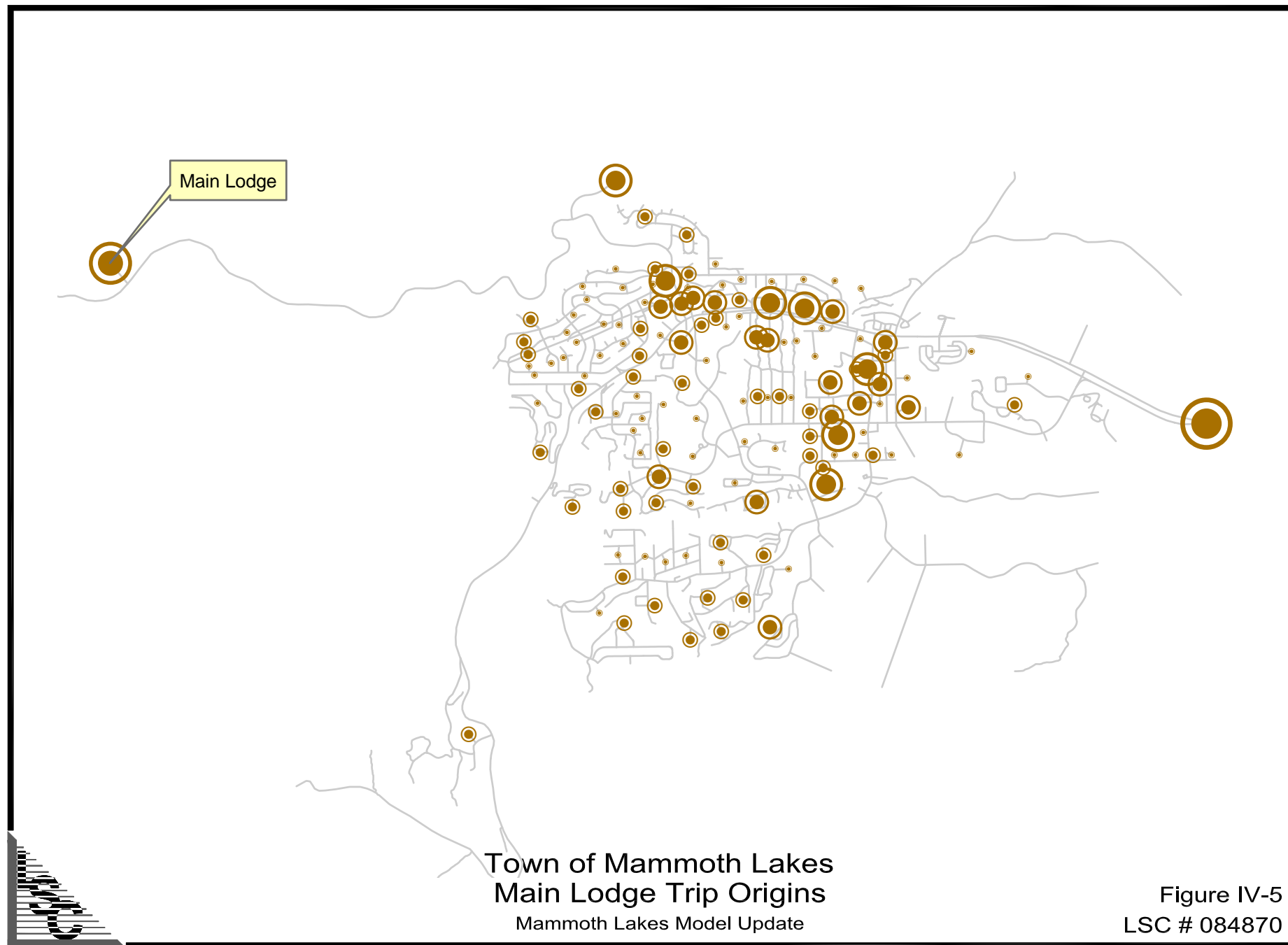


Figure IV-5
LSC # 084870

TRANSPORTATION
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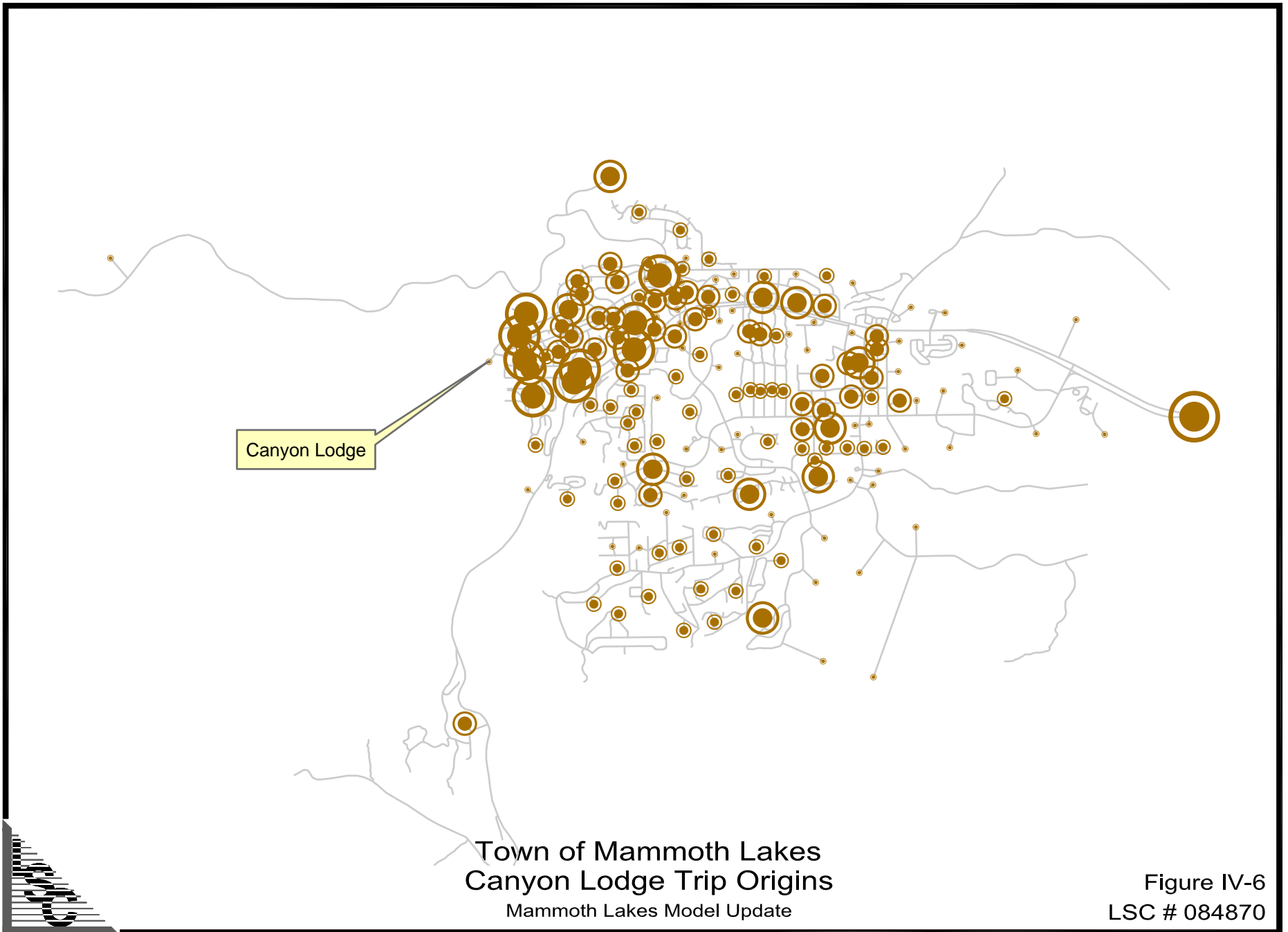
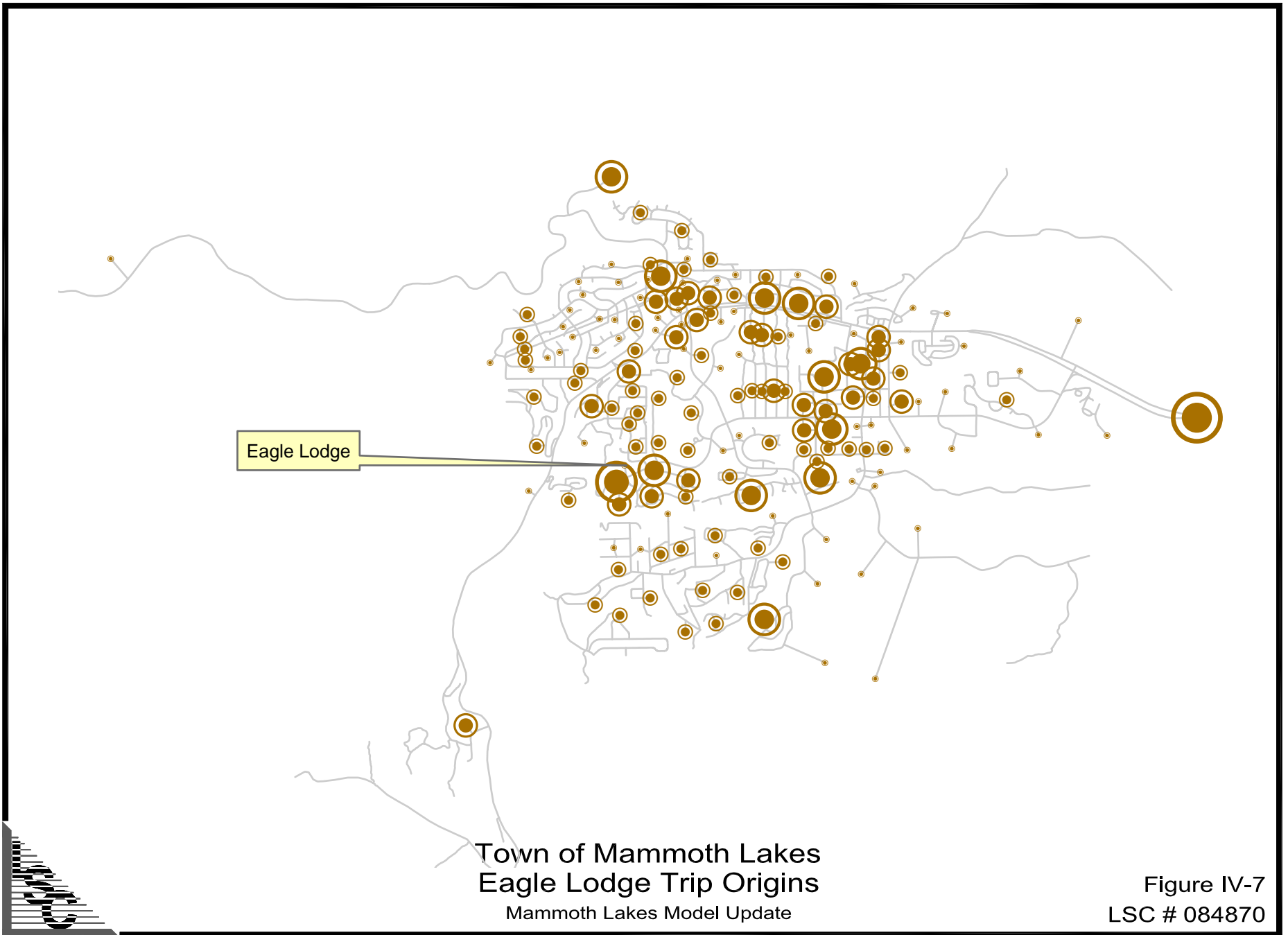


Figure IV-6
LSC # 084870



TRANSPORTATION
CONSULTANTS, INC.

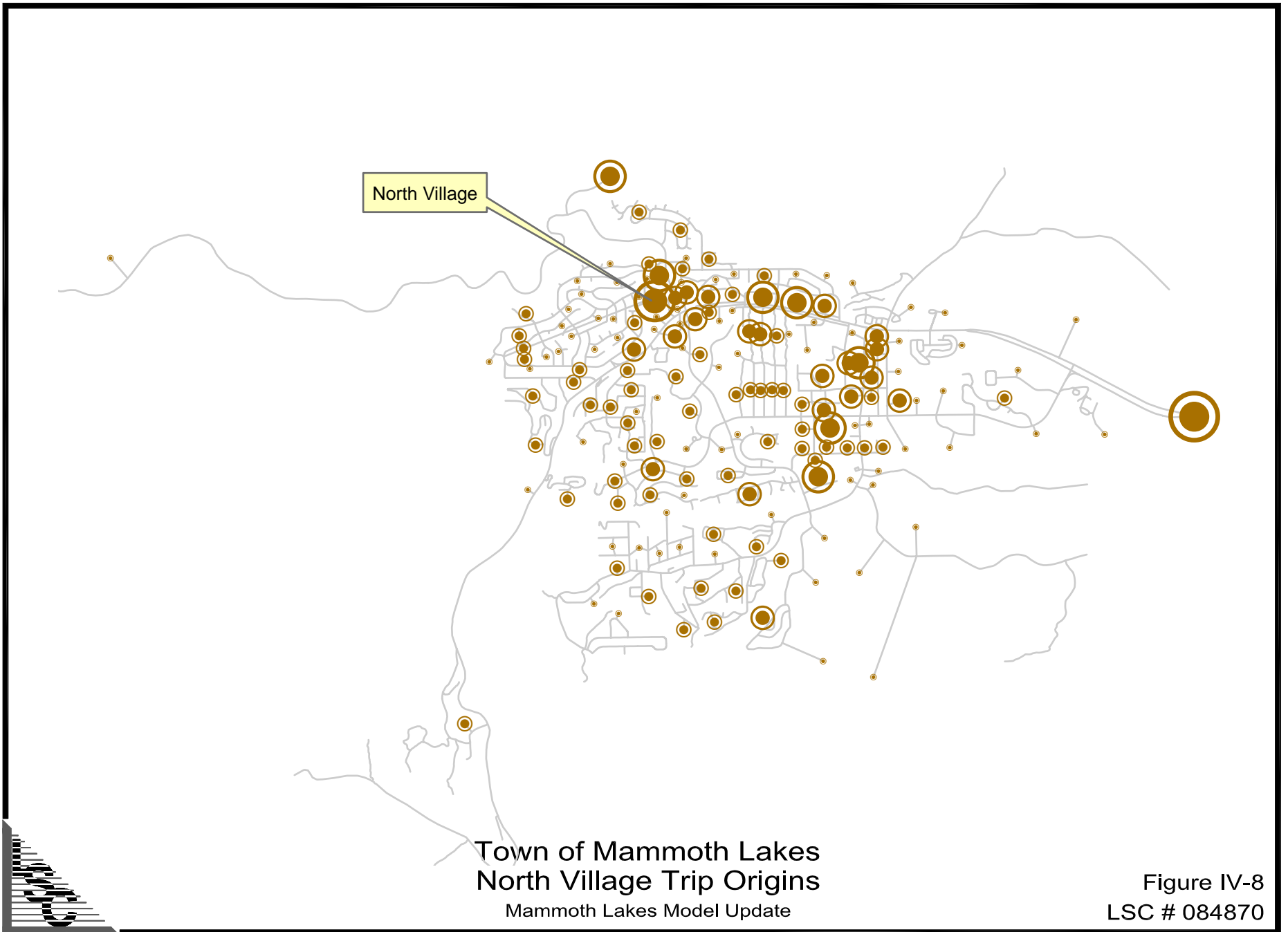


Figure IV-8
LSC # 084870

TRANSPORTATION
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CHAPTER V

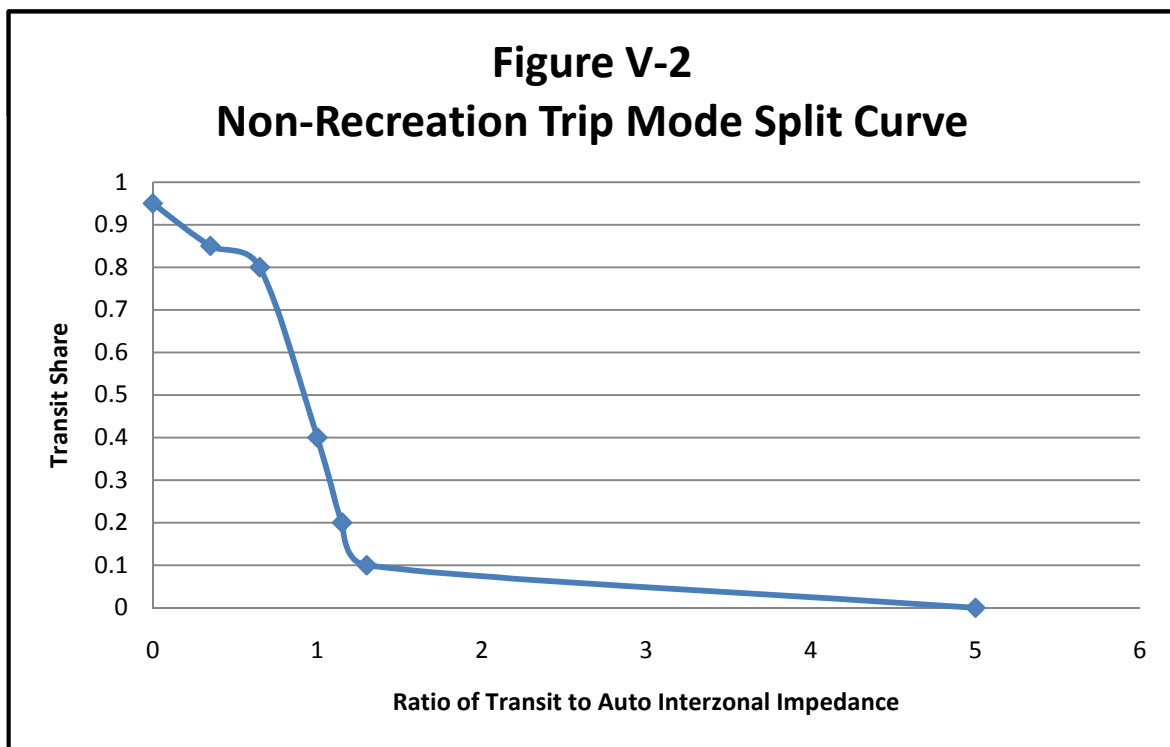
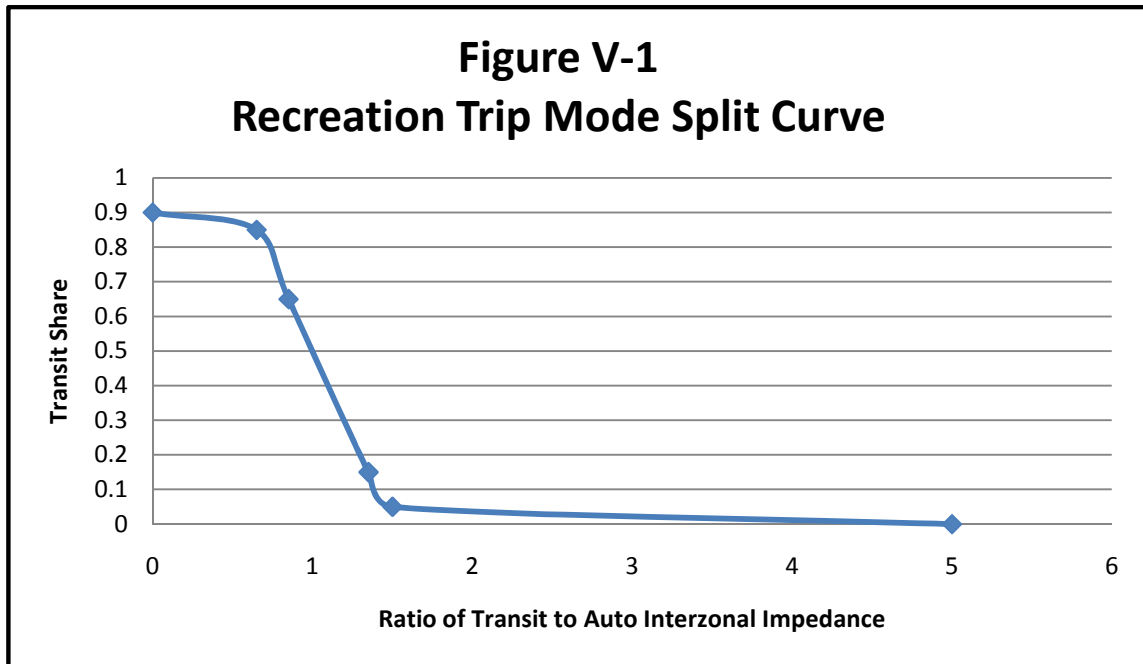
Mode Split

INTRODUCTION

Mode split refers to the allocation of person-trips between the available travel modes. The Town of Mammoth Lakes model includes two modes for travel—auto and transit. The process splits the trips for each origin-destination pair between the two trip modes. The end result provides the number of person-trips between each zone pair by mode.

MODE SPLIT METHODOLOGY

Mode split in the model was calculated by comparing auto travel times to transit travel times and applying a mode split curve. The logic behind a mode split curve is that potential transit riders will be more likely to choose transit if the travel time is similar to the auto travel time. Where these differences are large (i.e., areas far from transit services), the transit mode split will be low to reflect the lower attractiveness of transit options. Two separate mode split curves were used—one for home-based recreation trips and one for the other four trip purposes. The difference between them reflects a higher transit utilization for home-based recreation trips. This is due to the fact that the Town of Mammoth Lakes transit system is specifically designed to maximize ridership for recreation trips since the ski area portals currently have a low parking supply. The curves are shown in Figures V-1 and V-2 and are consistent with those used in the prior Town of Mammoth Lakes model.



In addition to using the mode split curves, mode split for recreation trip destinations at the ski areas was adjusted to match the observed mode split based on survey data collected by the Town. Table V-1 shows the mode split at the three ski area portals as collected in January 2009.

Table V-1 Observed Mode Split at Ski Gateways							
Gateway	Mode Choice Responses				Mode Choice Split		
	Vehicle	Transit	Walk	Total	Vehicle	Transit	Walk
Main	62	17	20	99	63%	17%	20%
Canyon	51	30	24	105	49%	29%	23%
Eagle	29	9	8	46	63%	20%	17%
Source: Town of Mammoth Lakes Survey, Dec. 2008.							

As shown, auto trips represented approximately 49 to 63 percent of total trips to the ski portals while transit trips ranged from 17 percent at the Main Lodge to 29 percent at Canyon Lodge. The higher percentage at Canyon Lodge is likely due to The Village Gondola which connects the Canyon Lodge ski area to The Village area near Minaret Road. In addition to the bus service, the gondola is included in the modeled transit network.

Based on these data, auto travel time penalties were calculated and inserted into the auto travel time skims to calibrate the mode split for recreation trips to the ski area data shown in Table V-1. In other words, if a skier base area had too high a vehicular mode share, then additional travel time was added to that base area for vehicular trips (auto, vanpool, etc.) to make it less attractive an option relative to transit. This was done only at the base area so that it did not affect vehicular trips to adjacent zones. These penalties, shown below, account for the reduced attractiveness of auto trips due to various factors, including low parking supply and congestion at the ski area portals.

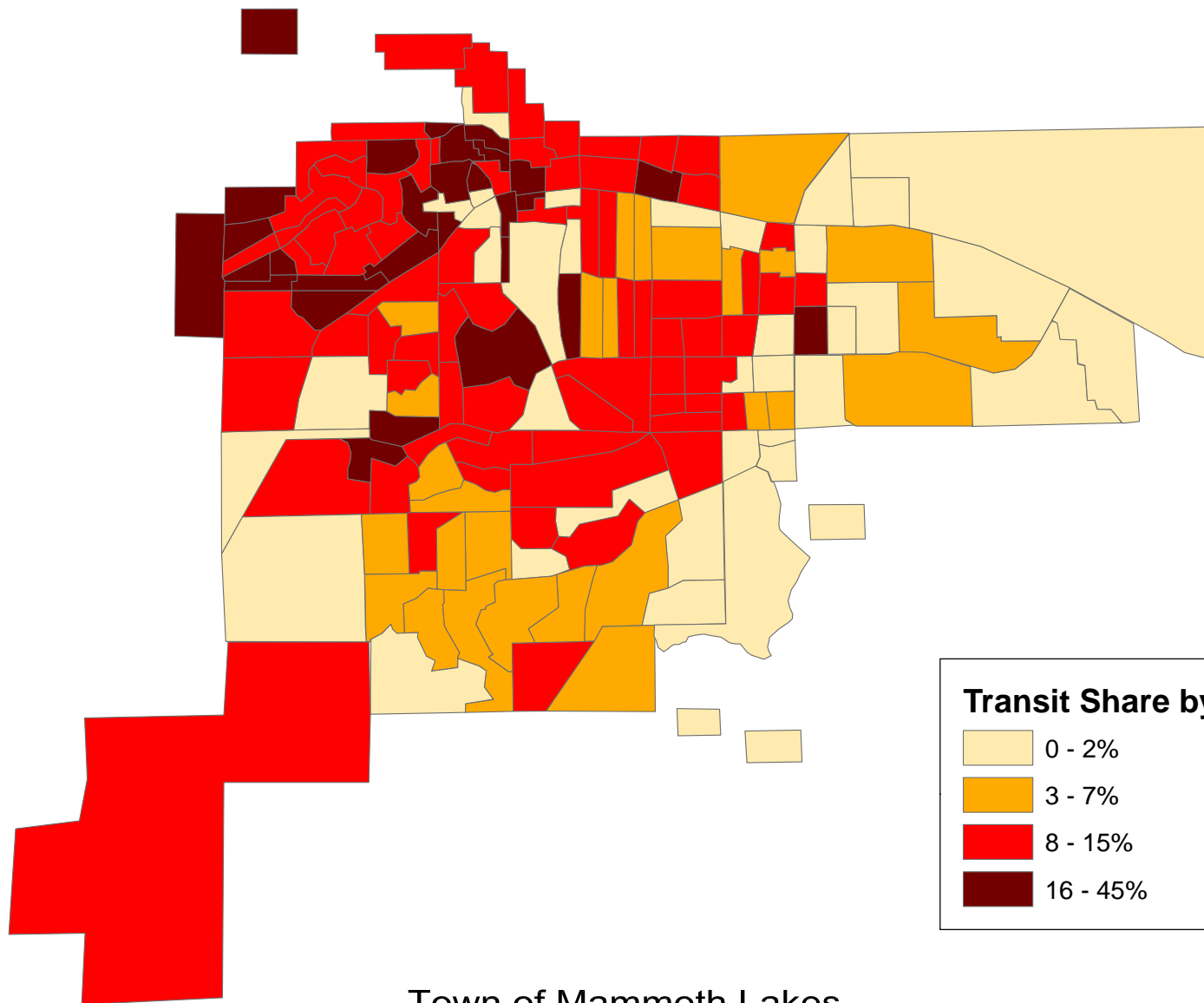
- Main Lodge = 21 minutes, 16 seconds
- Canyon Lodge = 19 minutes, 49 seconds
- Eagle Lodge = 11 minutes

Finally, additional penalties were added to TAZs 19, 28, and 30, which represent the resort areas surrounding The Village. A 10-minute penalty was added to account for lower parking supply in the area and the presence of The Village Gondola.

RESULTS

The resulting mode split by TAZ is shown in Figure V-3. As shown, transit share is high at the three ski area portals as well as areas surrounding The Village and the gondola. Transit share is also high along Main Street and Old Mammoth Road due to the transit routes that serve these areas. Overall, transit share is approximately 15 percent for all trip purposes with home-based recreation trips having the largest share at approximately 35 percent. This is due to the high transit share at the ski area portals. Table V-2 shows the final transit share by trip purpose. Table V-3 shows the final transit share at the four ski portals.

Table V-2					
Mode Choice by Trip Purpose					
Trip Purpose	Daily Person-Trips by Mode			Mode Split	
	Vehicle	Transit	Total	Vehicle	Transit
H-REC	31,200	16,462	47,662	65.5%	34.5%
H-S	19,830	440	20,270	97.8%	2.2%
H-W	9,787	213	10,000	97.9%	2.1%
H-O	28,718	844	29,562	97.1%	2.9%
O-O	24,846	2,126	26,972	92.1%	7.9%
Totals	114,381	20,084	136,465	85.1%	14.9%
Source: LSC, 2010.					



Town of Mammoth Lakes
Transit Share by TAZ
Mammoth Lakes Model Update

Figure V-3
LSC # 084870

Table V-3 Mode Choice at Ski Area Gateway (All Trip Purposes)						
Gateway	TAZ	Daily Person-Trips by Mode			Mode Split	
		Vehicle	Transit	Total	Vehicle	Transit
Main	1	10,256	4,891	15,147	67.7%	32.3%
Canyon	42	6,919	2,705	9,624	71.9%	28.1%
Eagle	130	2,070	1,107	3,177	65.2%	34.8%
North Village	28	3,189	1,466	4,655	68.5%	31.5%
Source: LSC, 2010.						

As shown, transit shares at the ski portals range from 35 percent at Eagle Lodge to 28 percent at Canyon Lodge. These percentages compare well to the actual transit share shown in Table V-1 with the differences caused by the fact that the data in Table V-1 are for home-based recreation trips only and include the walk mode while the shares shown in Table V-3 are for all trip purposes and include only vehicle and transit modes. Since the other non-recreation trip purposes generally have a lower transit share, the totals in Table V-3 are lower than those shown in Table V-1.

To further confirm the correct transit share, total transit system boardings from the model were compared to current ridership data provided by the Town of Mammoth Lakes. The results show that model-generated transit boardings are within three percent of the actual transit boardings. Since the level of transit use is correctly represented in the model, this confirms that the correct transit share is being used. This is important since it ensures that the correct number of vehicle-trips are used in the vehicle assignment.

P-A to O-D TRANSFORMATION

The final step before assignment is to convert the production-attraction (P-A) person-trips between TAZ pairs to origin-destination (O-D) transit and auto trips. Specifically, the production-attraction person-trips generated in the trip distribution step were first split into transit and auto person-trips using the mode split data discussed above. The resulting daily transit person-trips were then used in the transit assignment step discussed in Chapter VI. For daily auto trips, the

transformation involved conversion from person-trips to auto trips. This conversion required the use of occupancy factors, or the average number of persons per vehicle. Vehicle occupancy factors generally differ based on trip purpose. The following vehicle occupancy factors were used in the model:

- Home-based recreation trips = 3.0 persons per vehicle
- Home-based work trips = 1.1 persons per vehicle
- Home-based shopping, home-based other, and other-to-other trips = 1.8 persons per vehicle

These vehicle occupancy factors were estimated based on several sources, including the *2001 National Household Travel Survey* (NHTS), *NCHRP 365 - Travel Estimation Techniques for Urban Planning*, the US Census data shown in Table V-4, as well as adjustments made based on the count data in Chapter I.

Table V-4		
Private Vehicle Occupancy for Workers Age 16 and Older		
Travel Time	Persons	
	Number	Percentage
Drove Alone (SOV)	2,543	78.7%
2-person carpool	654	20.2%
3-person carpool	21	0.6%
4-person carpool	13	0.4%
5-or-more-person carpool	0	0.0%
Total	3,231	100.0%
Computed Average Auto Occupancy		1.23
Source: US Census Bureau, 2000 Census, SF4, Table PCT60; LSC Computation of Average Auto Occupancy, 2009.		

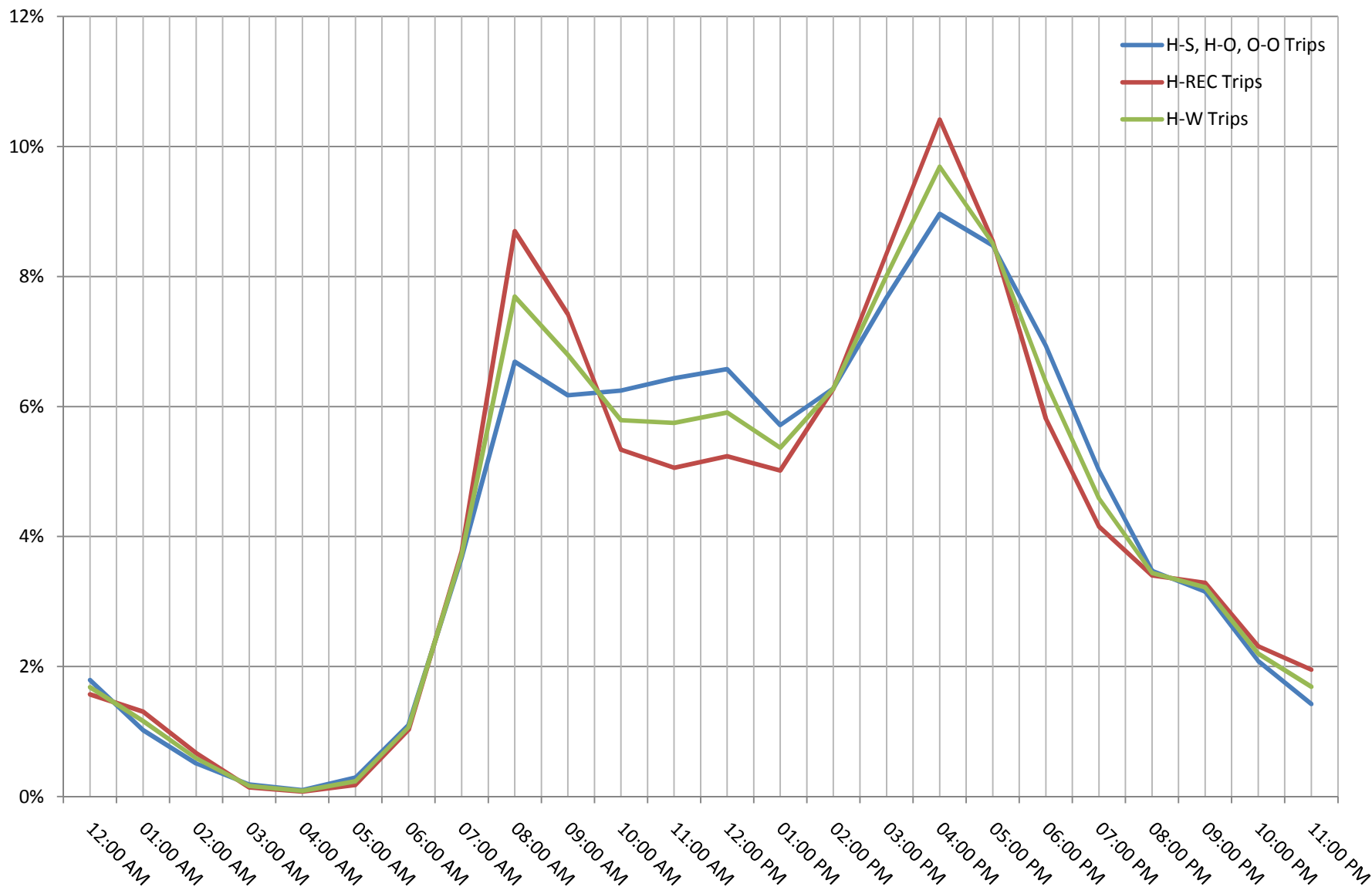
Once the daily origin-destination transit and auto trips were calculated using the P-A to O-D transformation, the daily trips were converted to peak-hour trips using daily distribution curves. Different curves were used for home-based recreation, home-based work, and the other three trip purposes (home-based shopping, home-based other, and other-to-other). The curves were calculated based on the daily count data shown in Figure I-3. For home-based recreation trips, the count along Minaret Road near The Village was used since it was assumed to contain mostly recreation trips driving to and from the Main Lodge ski area. For home-based shopping trips, home-based other trips, and other-to-other trips, the curve

was calculated by taking an average from various count locations throughout the town.

Finally, the home-based work curve was calculated by averaging the recreation-based and the home-based shopping, home-based other, and other-to-other curves. This assumption was considered reasonable since a large proportion of peak winter Saturday work trips are associated with recreational uses, but do not experience the large peaking characteristics of home-based recreation trips. The resulting daily distribution curves are shown in Figure V-4.

As shown in Figure V-4, the peak hour for all three daily distribution curves is 4:00 to 5:00 p.m. As a result, data for this hour were used to calculate the peak winter Saturday peak-hour auto O-D trips to be used in the peak-hour auto assignment.

Figure V-4
Hourly Distribution by Trip Purpose





CHAPTER VI

Assignment

INTRODUCTION

This chapter discusses the trip assignment models that were used to estimate traffic flow on the network using the origin-destination pairs generated in trip distribution. The assignment of trips to the network relies on the determination of routes through the network based on the impedance or travel time of each link.

ASSIGNMENT METHODOLOGY

Various assignment procedures are available depending on the type of estimate desired.¹ TransCAD provides six options for trip assignment as follows:

- All or Nothing
- Capacity Restraint
- Incremental
- User Equilibrium
- Stochastic User Equilibrium
- System Optimum

The Stochastic User Equilibrium (SUE) method, which uses an iterative process to achieve a solution based upon travel time and capacity, was used in the model. The solution reached is an assignment in which no travelers can improve their travel times by shifting routes or a state of “user equilibrium.” In each iteration, network link flows are computed, which incorporate link capacity restraint effects and flow-dependent travel times. SUE assumes travelers do not have perfect

1

The all-or-nothing method is typically used to identify where traffic would go if there were no capacity limitations. Capacity restraint and incremental assignment methods are older, less robust methods of allocating traffic volumes with some consideration for congestion, but do not provide “feedback loops” for the assignment to reach an optimum allocation. User equilibrium (UE) contains a feedback loop and assumes all drivers know the street network perfectly. In practice, many drivers do not always exit congested facilities (i.e., highways) for side streets because they do not know their way and/or are unaware that side streets might be faster. UE is practicable in a smaller urban area like Mammoth Lakes, and SUE still offers some advantages. The system optimum method offers more tools to segregate traffic by types (e.g., trucks vs. cars), a capability that is not yet needed for the Town of Mammoth Lakes Model.

information concerning network attributes and/or they perceive travel costs in different ways. The assignment results are more realistic because SUE permits use of less attractive as well as the most attractive routes.

The traffic assignment procedure uses the following Bureau of Public Roads (BPR) volume delay function to update travel times based upon the volume assigned to each roadway:

$$T_i = t_i \times \left[1 + \alpha \left(\frac{x_i}{C_i} \right)^\beta \right]$$

where: T_i = Congested travel time on link i
 t_i = Free-flow travel time on link i
 x_i = Volume on link i
 C_i = Capacity of link i
 α, β = Calibration parameters

As roadways begin to approach capacity, the travel time along those roadways is recalculated in the traffic assignment procedure. The newly calculated travel times are then used to assign another portion of the traffic. The model is designed to stop iterating once adequate equilibrium is reached (which under existing conditions occurs after four iterations for the daily assignment and six iterations for the peak-hour assignment). As roadways become more congested in the future, more iterations will be needed.

ROADWAY ASSIGNMENT

All-Day Traffic Assignment

Daily assignment was performed using the daily origin-destination trip information and the existing roadway network. Daily roadway capacities were used along with the BPR volume delay function to calculate congested travel times. The assignment model performed a total of four iterations before equilibrium was reached.

To validate the daily model results, the model traffic assignment was compared to the observed traffic volumes presented in Figure I-3. The approach to the validation process is to conduct a point validation analysis. Point validation represents a higher standard for calibration than is typically used. Not only are overall flows of traffic volumes compared, but also site-specific volumes. A calibrated model should provide results that are reasonably close for major links in the street network. Table VI-1 shows the two-way volume error range that was used in validating the model. For low-volume links, a larger error range is acceptable because of the lack of congestion. A difference of 100 percent for volumes less than 1,000 vehicles per day has little effect on congestion because less roadway capacity is being used. For higher volume roadways, the percentage error must be much smaller.

Table VI-1 Point Validation Error Range - Daily	
Daily Two-Way Traffic Volumes	Error Range +/-
< 1,000	100%
1,000 - 3,999	50%
4,000 - 9,999	25%
10,000 - 15,000	15%
> 15,000	10%

During the validation process, links with non-validating traffic counts were identified. In order to have the model accurately match actual traffic counts and therefore represent the actual travel patterns of the Town of Mammoth Lakes, iterative adjustments were made to the impedances of the model network. Calibrated model parameters that establish the base-year model were used in modeling the future growth projections and to evaluate alternate transportation network improvements. Table VI-2 shows the links that were adjusted and the corresponding increase in impedance that was made in order to improve the model's representation of existing travel patterns.

Table VI-2 Daily Vehicular Assignment - Impedance Adjustments		
Link No.	Street Name	Added Travel Time (min.)
9	Canyon Blvd.	0.35000
10	Canyon Blvd.	0.24001
30	Forest Trail	0.11992
33	Forest Trail	0.35743
45	Grindelwald Road	0.79991
55	Lake Mary Road	0.56071
57	Lakeview Blvd.	0.19996
126	Sierra Nevada Road	0.24000
157	Main Street	0.05998
158	Main Street	0.15499
162	Main Street	0.04008
167	Minaret Road	0.40000
177	Sierra Park Road	0.20003
179	Tavern Road	0.33997
186	Forest Trail	0.62557
196	Crest Lane	0.20000
200	Tavern Road	0.62003
201	Tavern Road	0.20009
205	Sierra Manor Road	0.19002
206	Sierra Park Road	0.05598
326	Davison Road	0.09994
337	Sierra Blvd.	0.59994
350	Chateau Road	0.23999
361	Meridian Blvd.	0.20005
376	Old Mammoth Road	0.60006
377	Old Mammoth Road	0.20001
397	Kelley Road	0.18004
411	South Frontage Road	0.05804
413	South Frontage Road	0.00504
414	Main Street Access	0.01996
415	Main Street	0.08896
416	Main Street Access	-0.00001
417	South Frontage Road	0.10000
425	Main Street Access	0.28004
429	Center Street	0.01001
468	Forest Trail	0.08201
472	Main Street	0.11596
511	Meridian Blvd.	0.21998
524	Lee Road	0.02998
525	Sawmill Cutoff Road	0.60008

Table VI-2
Daily Vehicular Assignment - Impedance Adjustments

Link No.	Street Name	Added Travel Time (min.)
541	Minaret Road	0.35996
542	Lakeview Blvd.	0.19999
602	Old Mammoth Road	0.11994
37165206	Sierra Manor Road	0.00004
37165207	Sierra Center Centroid Connector	0.20009
37165240	Forest Trail	0.13999
37165325	Lake Mary Road	0.83610
37165692	Old Mammoth Road	0.07995
37165365	Berner Street	0.41992
37165368	Berner Street	0.59999
37165374	Minaret Road	0.04000
37165376	Canyon Blvd.	0.76159
37165415	North Majestic Pines Drive	0.69993
37165459	Rainbow Lane	0.40008
37165473	Azimuth Drive	0.79991
37165477	Sierra Nevada Road	0.39999
37165517	Main Street	0.09998
37165518	Laurel Mountain Road	0.03998
37165521	Forest Trail	0.06002
37165524	South Frontage Road	0.04003
37165525	Main Street	0.11596
37165527	Main Street	0.19993
37165529	Manzanita Road	0.19991
37165534	Mountain Blvd.	1.00002
37165541	Lake Mary Road	0.02002
37165573	Meridian Blvd.	0.40003
37165631	Meridian Blvd.	0.65999
37165636	Von's Centroid Connector	0.62992
37165640	South Frontage Road	0.00797
37165641	Main Street Centroid Connector	0.00998
37165644	Old Mammoth Road	0.08003
37165647	Old Mammoth Road Centroid Connector	0.16996
37165670	Minaret Road	0.19994

Source: From ADT_TT_adjustments.bin, LSC, 2010.

Assignment

As shown, a total of 73 links were adjusted in order to calibrate the daily assignment to existing count data. Increases to impedance varied from approximately one second to 60 seconds.

Once the model was run with the impedance adjustments listed in Table VI-2, the model generated several files. The output from the run was a 24-hour traffic volume loaded network. The following is a summary of the model results:

- Total Trips = 60,072
- Daily Vehicle-Miles Traveled (VMT) = 144,192
- Daily Vehicle-Hours Traveled (VHT) = 11,621
- Average Vehicle Speed (mph) = 27.0

The above results are a key baseline for comparison of different future transportation scenarios. When the number of trips is divided into the VMT, the average trip distance is 2.40 miles.

The daily VMT number is calculated as follows. Each link has a length and a volume in each direction. A two-mile link with a volume in each direction of 10,000 trips per day would result in 40,000 vehicle-miles traveled (2-mile link x 10,000 vehicle-trips x 2 directions). The sum of all links in the network, both directions, or single direction in the case of one-way streets, is added together to generate the daily systemwide VMT. Note the daily VMT for this model is based on the network representation using 1,028 links to define the road network.

Table VI-3 shows the calibrated link volumes compared to the actual 2009 daily traffic counts collected in the field.

Table VI-3
Daily Vehicular Assignment Comparison - Calibrated Model Results

Link No.	Street Name	Actual Daily Volume	Existing Model Daily Volume	Error	Acceptable Error	Within Acceptable Error?
17	Canyon Blvd.	3,730	3,943	5.7%	50%	Yes
30	Forest Trail	1,030	1,008	2.2%	50%	Yes
33	Forest Trail	630	1,260	100.0%	100%	Yes
55	Lake Mary Road	6,250	4,783	23.5%	25%	Yes
167	Minaret Road	4,750	4,664	1.8%	25%	Yes
186	Forest Trail	2,510	3,626	44.5%	50%	Yes
206	Sierra Park Road	1,180	1,381	17.1%	50%	Yes
224	Minaret Road	4,150	4,212	1.5%	25%	Yes
326	Davison Road	760	1,284	69.0%	100%	Yes
350	Chateau Road	1,270	1,297	2.1%	50%	Yes
361	Meridian Blvd.	6,070	6,304	3.9%	25%	Yes
376	Old Mammoth Road	4,830	5,019	3.9%	25%	Yes
377	Old Mammoth Road	4,720	5,019	6.3%	25%	Yes
397	Kelley Road	1,500	2,068	37.9%	50%	Yes
415	Main Street	13,080	14,450	10.5%	15%	Yes
467	Minaret Road	9,580	9,396	1.9%	25%	Yes
468	Forest Trail	1,080	1,490	38.0%	50%	Yes
511	Meridian Blvd.	4,900	5,029	2.6%	25%	Yes
525	Sawmill Cutoff Road	350	72	79.3%	100%	Yes
541	Minaret Road	6,980	6,306	9.6%	25%	Yes
552	Highway 203	3,670	3,925	7.0%	50%	Yes
557	Mammoth Scenic Loop	240	286	19.3%	100%	Yes
602	Old Mammoth Road	10,250	9,012	12.1%	15%	Yes
621	Highway 203	4,010	4,288	6.9%	25%	Yes
622	Highway 203	4,010	4,288	6.9%	25%	Yes
37165198	Highway 203	3,670	3,924	6.9%	50%	Yes
37165202	Meridian Blvd.	2,780	3,481	25.2%	50%	Yes
37165216	Chateau Road	1,480	1,679	13.5%	50%	Yes
37165365	Berner Street	170	187	10.0%	100%	Yes
37165374	Minaret Road	7,910	9,292	17.5%	25%	Yes
37165376	Canyon Blvd.	6,630	8,182	23.4%	25%	Yes
37165509	Highway 203	6,530	7,988	22.3%	25%	Yes
37165517	Main Street	16,560	17,825	7.6%	10%	Yes
37165544	Lake Mary Road	2,100	1,131	46.1%	50%	Yes
37165559	Old Mammoth Road	5,200	6,477	24.5%	25%	Yes
37165589	Meridian Blvd.	2,590	3,192	23.2%	50%	Yes
37165631	Meridian Blvd.	6,470	6,731	4.0%	25%	Yes
37165644	Old Mammoth Road	10,590	10,326	2.5%	15%	Yes
	Total	174,210	184,829	6.1%		
	Total for Key Roadways	122,530	127,864	4.4%		

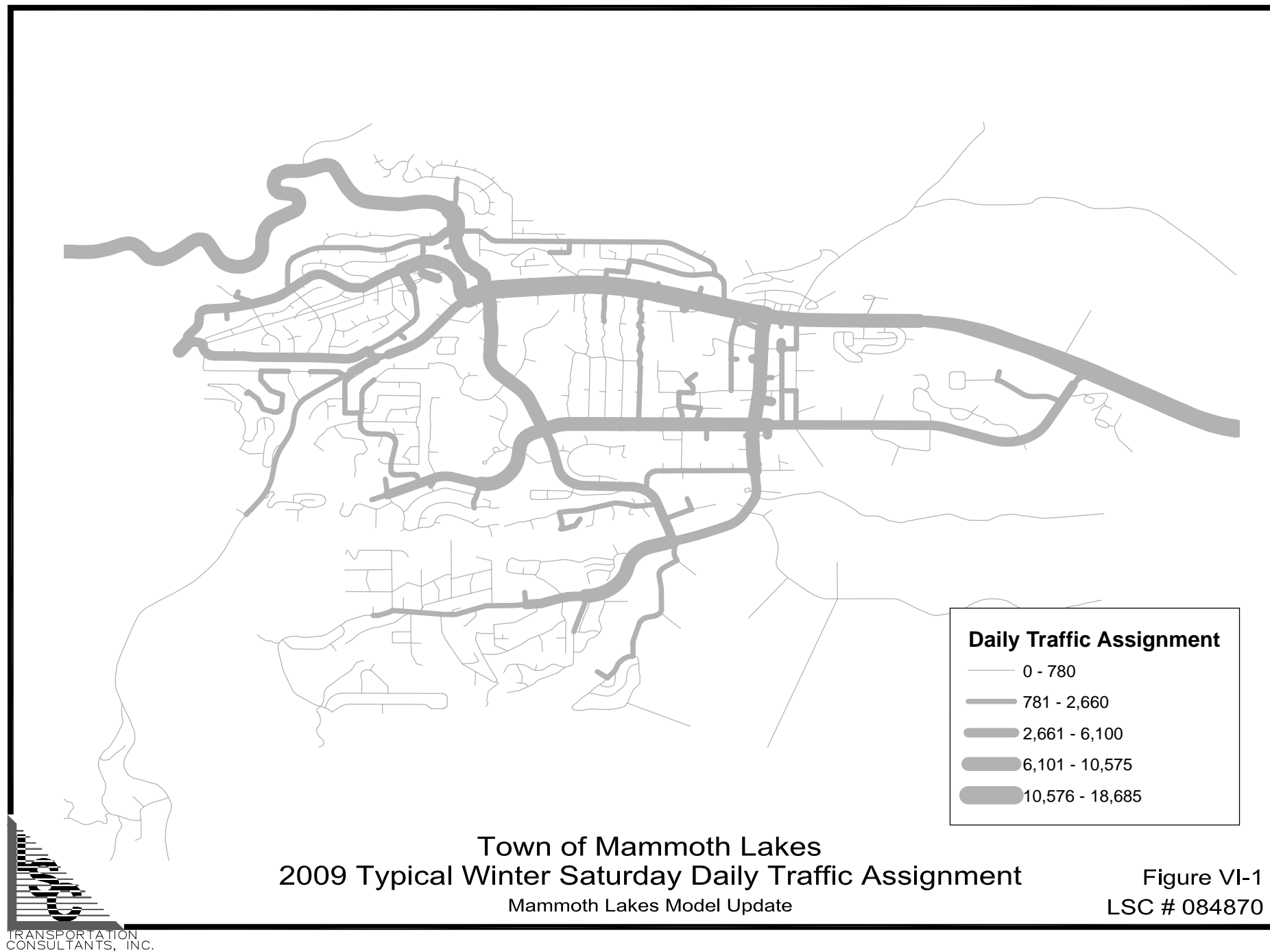
Source: LSC, 2010.

As shown, model volumes on all 38 links are within the acceptable error ranges shown in Table VI-1. Overall, for existing conditions, model volumes were within 6.1 percent of actual daily volumes. Figure VI-1 presents the traffic volume along all the network links compared to each other. As the traffic volume increases on a link, the bandwidth or thickness of the link increases. Hence, the greater the bandwidth, the greater the volume on the link. The bandwidth graphically reflects the travel patterns on the transportation system. As Figure VI-1 indicates, most traffic uses Main Street, Meridian Boulevard, Old Mammoth Road, and Minaret Road.

Peak-Hour Traffic Assignment

Peak-hour assignment was performed using the peak-hour origin-destination trip information and the existing roadway network. Hourly roadway capacities were used along with the BPR volume delay function to calculate congested travel times. However, unlike the daily assignment, the peak-hour assignment incorporated delay at signalized intersections. This provides a more realistic assignment because intersection delays are added to travel times to calculate the total travel time for a specific path. In order to account for signalized intersection delay, various intersection-related data were input into the model at the five signalized intersections in the Town of Mammoth Lakes. These data included lane geometry, length of auxiliary lanes, signal phasing, and cycle lengths. During the assignment process, delay at these signalized intersections is calculated using the delay model from the *2000 Highway Capacity Manual*. In this methodology, the turning movement delay is divided into a uniform delay and an incremental delay (due to non-uniform arrivals).

Once the additional data were input into the model, the peak-hour assignment with volume-dependent turning delays was run. The model performed a total of six iterations before equilibrium was reached.



Daily Traffic Assignment

- 0 - 780
- 781 - 2,660
- 2,661 - 6,100
- 6,101 - 10,575
- 10,576 - 18,685

Figure VI-1
 LSC # 084870

Assignment

To validate the peak-hour model results, the model traffic assignment was compared to the observed peak-hour link traffic volumes presented in Figure I-4. Table VI-4 shows the two-way volume error range that was used in validating the peak-hour model.

Table VI-4 Point Validation Error Range - Peak Hour	
Peak-Hour Two-Way Traffic Volumes	Error Range +/-
< 100	100%
100 - 399	50%
400 - 999	25%
1,000 - 1,500	15%
> 1,500	10%

During the validation process, links with non-validating traffic counts were identified. In order to have the model accurately match actual traffic counts and therefore represent the actual travel patterns of the Town of Mammoth Lakes, iterative adjustments were made to the impedances of the model network. Calibrated model parameters that establish the base-year model were used in modeling the future growth projections and to evaluate alternate transportation network improvements. Table VI-5 shows the links that were adjusted and the corresponding increase in impedance that was made in order to improve the model's representation of existing travel patterns.

Table VI-5 Peak-Hour Vehicular Assignment - Impedance Adjustments		
Link No.	Street Name	Added Travel Time (min.)
9	Canyon Blvd.	0.1750
10	Canyon Blvd.	0.1200
30	Forest Trail	0.0800
33	Forest Trail	0.3487
45	Grindelwald Road	0.9400
57	Lakeview Blvd.	0.1000
126	Sierra Nevada Road	0.2700
128	Sierra Nevada Road	0.2000
167	Minaret Road	0.1500
177	Sierra Park Road	0.0900
186	Forest Trail	0.5928
196	Crest Lane	0.1000
200	Tavern Road	0.5100
201	Tavern Road	0.1000
205	Sierra Manor Road	0.1740
206	Sierra Park Road	0.0600
224	Minaret Road	0.0200
244	Villa Vista Drive	0.6000
279	Lakeview Blvd.	0.1000
326	Davison Road	0.1300
337	Sierra Blvd.	0.4000
350	Chateau Road	0.2700
361	Meridian Blvd.	0.1000
376	Old Mammoth Road	0.3000
377	Old Mammoth Road	0.1000
397	Kelley Road	0.7000
414	Main Street Access	0.2000
425	Main Street Access	0.2000
429	Center Street	0.2000
37165690		0.0000
468	Forest Trail	1.1150
472	Main Street	0.0200
511	Meridian Blvd.	0.1100
525	Sawmill Cutoff Road	0.6000
541	Minaret Road	0.1100
542	Lakeview Blvd.	0.1000

Table VI-5 Peak-Hour Vehicular Assignment - Impedance Adjustments		
Link No.	Street Name	Added Travel Time (min.)
602	Old Mammoth Road	0.2500
37165207		0.1000
37165240	Forest Trail	0.1000
37165276	Sierra Star Parkway	0.2000
37165325	Lake Mary Road	0.0651
37165692	Old Mammoth Road	0.0300
37165365	Berner Street	0.2100
37165368	Berner Street	0.3000
37165374	Minaret Road	0.0000
37165376	Canyon Blvd.	0.5030
37165415	North Majestic Pines Drive	0.8100
37165459	Rainbow Lane	0.2000
37165473	Azimuth Drive	0.4400
37165477	Sierra Nevada Road	0.2000
37165488		0.2200
37165518	Laurel Mountain Road	0.1700
37165525	Main Street	0.2200
37165527	Main Street	0.1000
37165534	Mountain Blvd.	0.5000
37165573	Meridian Blvd.	0.2000
37165574	Laurel Mountain Road	0.1000
37165620		0.5800
37165621		0.6000
37165623		0.1000
37165689		0.7500
37165631	Meridian Blvd.	0.3300
37165636		0.7750
37165644	Old Mammoth Road	0.1920
37165647		0.3000
37165670	Minaret Road	0.0800
Source: LSC, 2010.		

As shown, a total of 66 links were adjusted in order to calibrate the peak-hour assignment to existing count data. Increases to impedance varied from approximately one second to 67 seconds.

Once the model was run with the impedance adjustments listed in Table VI-3, the model generated a peak-hour traffic volume loaded network. Table VI-6 shows the calibrated link volumes compared to the actual 2009 peak-hour traffic counts collected in the field.

Table VI-6 Peak-Hour Vehicular Assignment Comparison - Calibrated Model Results						
Link No.	Street Name	Actual Peak-Hour Volume	Existing Model Peak-Hour Volume	Error	Acceptable Error	Within Acceptable Error?
17	Canyon Blvd.	438	530	21.1%	50%	Yes
30	Forest Trail	157	227	44.6%	50%	Yes
33	Forest Trail	81	18	77.9%	100%	Yes
55	Lake Mary Road	420	359	14.5%	25%	Yes
160	Main Street	830	1,026	23.6%	25%	Yes
167	Minaret Road	475	449	5.4%	25%	Yes
168	Minaret Road	1,035	908	12.3%	15%	Yes
169	Minaret Road	810	774	4.4%	25%	Yes
177	Sierra Park Road	155	232	49.5%	50%	Yes
179	Tavern Road	99	105	5.8%	100%	Yes
186	Forest Trail	340	402	18.3%	50%	Yes
200	Tavern Road	59	29	50.1%	100%	Yes
206	Sierra Park Road	123	164	33.2%	50%	Yes
212	Meridian Blvd.	810	768	5.1%	25%	Yes
224	Minaret Road	389	440	13.1%	25%	Yes
326	Davison Road	76	85	12.4%	100%	Yes
328	Lake Mary Road	1,136	1,145	0.8%	15%	Yes
349	Meridian Blvd.	470	375	20.1%	25%	Yes
350	Chateau Road	117	75	36.0%	50%	Yes
361	Meridian Blvd.	606	618	1.9%	25%	Yes
376	Old Mammoth Road	548	519	5.2%	25%	Yes
377	Old Mammoth Road	472	519	10.0%	25%	Yes
441	Lake Mary Road	374	350	6.3%	50%	Yes
467	Minaret Road	1,001	893	10.8%	25%	Yes
468	Forest Trail	157	171	9.2%	50%	Yes
472	Main Street	1,411	1,457	3.3%	15%	Yes
512	Meridian Blvd.	488	458	6.1%	25%	Yes
525	Sawmill Cutoff Road	35	11	67.2%	100%	Yes
541	Minaret Road	717	781	8.9%	25%	Yes
557	Mammoth Scenic Loop	22	29	33.7%	100%	Yes
602	Old Mammoth Road	846	737	12.9%	15%	Yes
37165216	Chateau Road	148	98	34.0%	50%	Yes
37165325	Lake Mary Road	372	370	0.5%	50%	Yes
37165327	Lake Mary Road	1,293	1,184	8.4%	15%	Yes
37165692	Old Mammoth Road	1,015	942	7.2%	15%	Yes
37165365	Berner Street	26	27	4.3%	100%	Yes
37165370	Minaret Road	955	813	14.9%	15%	Yes
37165376	Canyon Blvd.	662	776	17.3%	25%	Yes
37165415	North Majestic Pines Drive	147	172	17.1%	50%	Yes
37165517	Main Street	1,413	1,412	0.1%	10%	Yes
37165531	Main Street	1,440	1,400	2.8%	15%	Yes
37165544	Lake Mary Road	223	138	38.1%	50%	Yes
37165559	Old Mammoth Road	529	595	12.5%	25%	Yes
37165573	Meridian Blvd.	726	813	12.0%	25%	Yes
37165589	Meridian Blvd.	234	304	30.1%	50%	Yes
37165634	Meridian Blvd.	756	714	5.6%	25%	Yes
37165644	Old Mammoth Road	897	828	7.7%	15%	Yes
37165670	Minaret Road	910	1,134	24.6%	25%	Yes
Total		26,443	26,377	0.2%		
Source: LSC, 2010.						

Model volumes on all 48 links are within the acceptable error ranges shown in Table VI-4. Overall, for the base condition, model volumes were within one percent of actual peak-hour volumes. Figure VI-2 presents the peak-hour traffic volumes in the form of bandwidths. As the traffic volume increases on a link, the bandwidth or thickness of the link increases. As with daily volumes, most peak-hour traffic uses Main Street, Meridian Boulevard, Old Mammoth Road, and Minaret Road.

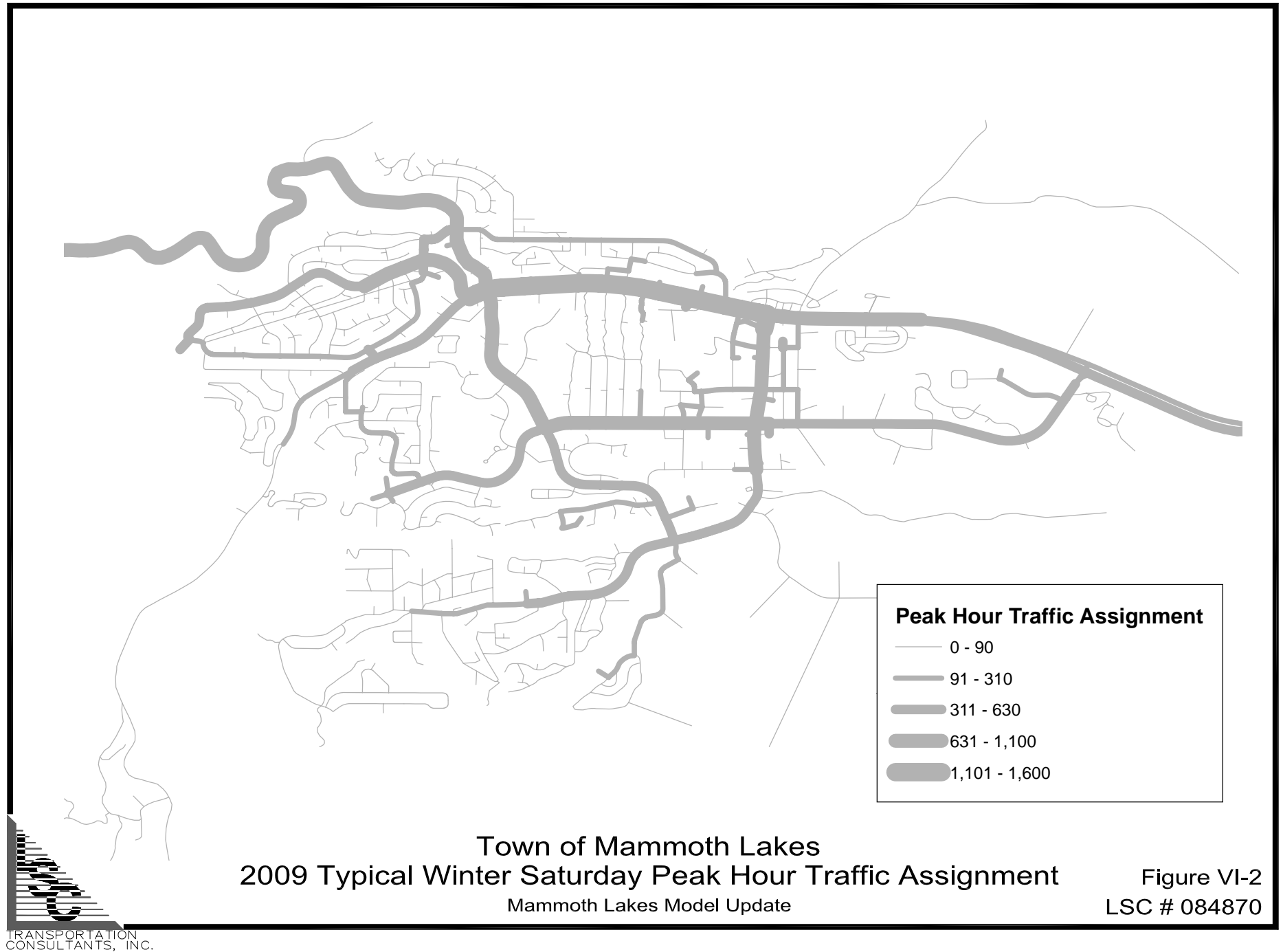


Figure VI-2
LSC # 084870

TRANSIT ASSIGNMENT

The last step involved running the validated model to generate the transit boarding estimates for the various transit routes in the Town of Mammoth Lakes. In order to validate the transit portion of the model, the typical winter day transit boardings provided by the Town of Mammoth Lakes were compared to model-generated boardings. The results are shown in Table VI-7.

Table VI-7 Transit Boarding Comparison - Calibrated Model Results			
Route	Actual Boardings	Existing Model Boardings	Percent Error
Red Line	6,700	6,710	0.1%
Green Line	1,800	1,370	23.9%
Blue Line	2,400	1,240	48.3%
Yellow Line	800	1,250	56.3%
Orange	100	210	110.0%
Mid-Town Lift	n/a	330	
Gondola	n/a	2,740	
Total	11,800	10,780	8.6%
<i>Sources: MMTS/TOML for actual and LSC, 2010.</i>			

Although the error for individual routes varies, it is within 25 percent for the routes with the majority of transit riders. Systemwide, the model-generated transit boardings are within nine percent of the actual transit boardings. This ensures that transit ridership is accurately accounted for in the model and the correct number of vehicle-trips are used in the vehicle assignment.



Future Year Model Validation

INTRODUCTION

The purpose of this chapter is to document the data used to produce the initial horizon year travel model. The chapter compares existing 2009 data and land uses to future (2030) data to show the predicted growth. Then the data are traced through the four steps of the model to verify that the model produces predictable results in each step. When that is shown, the chapter gives the results of the traffic assignment as a “base future” condition. The base future condition, then, is the point of comparison for land use and transportation network changes which are the subject of Chapter VIII.

Nominally, the horizon year is 20 years from the date of the 2007 General Plan, which would make the base future 2027. For purposes of this document, the rounded number of 2030 is used given that 2030 is 20 years from the current year.

NETWORK STABILITY

From 2009 through 2030, no additional roadway improvements are assumed. The extension of the Red Line into Snowcreek (down to TAZs 160 and 161) was the only transit network change included in the future base model. Thus the future transportation networks are stable and nearly identical across this 20-year planning horizon.

TRIP GENERATION

The Town of Mammoth Lakes General Plan expects permanent resident population to grow at a rate of 1.4 percent to 2.4 percent per year into the future. Table VII-1 shows how the Town has grown since 1970 and is forecast to grow through 2030. Figure VII-1 also shows this in graphic format. What these data communicate is

that the Town's permanent resident population is expected to grow 18-33 percent by 2020 and 36-68 percent by 2030.

Table VII-1 Population Growth Trends (1970-2030)				
Year	Population	Numerical Change	Average Annual Change	
			Number	Percent
1970	3,528			
1980	3,929	401	40	1.08%
1990	4,785	856	86	2.0%
2000	7,094	2,309	231	4.0%
2008	7,413	319	40	0.6%
2020	8,760 to 9,855	1346 to 2,441	112 to 203	1.4% to 2.4%
2030	10,065 to 12,491	1306 to 2,637	131 to 264	1.4% to 2.4%
Source: Census Bureau (2000 Census, SF3: P1) and (1990 Census, STF3: P1), DOF (Report E-5) as presented in the "Town of Mammoth Lakes Housing Element," December 2003; DOF & EDAW 2008 as presented in the "Town of Mammoth Lakes General Plan, Housing Element Draft," January 2009. LSC application of growth rates to 2020 and 2030.				

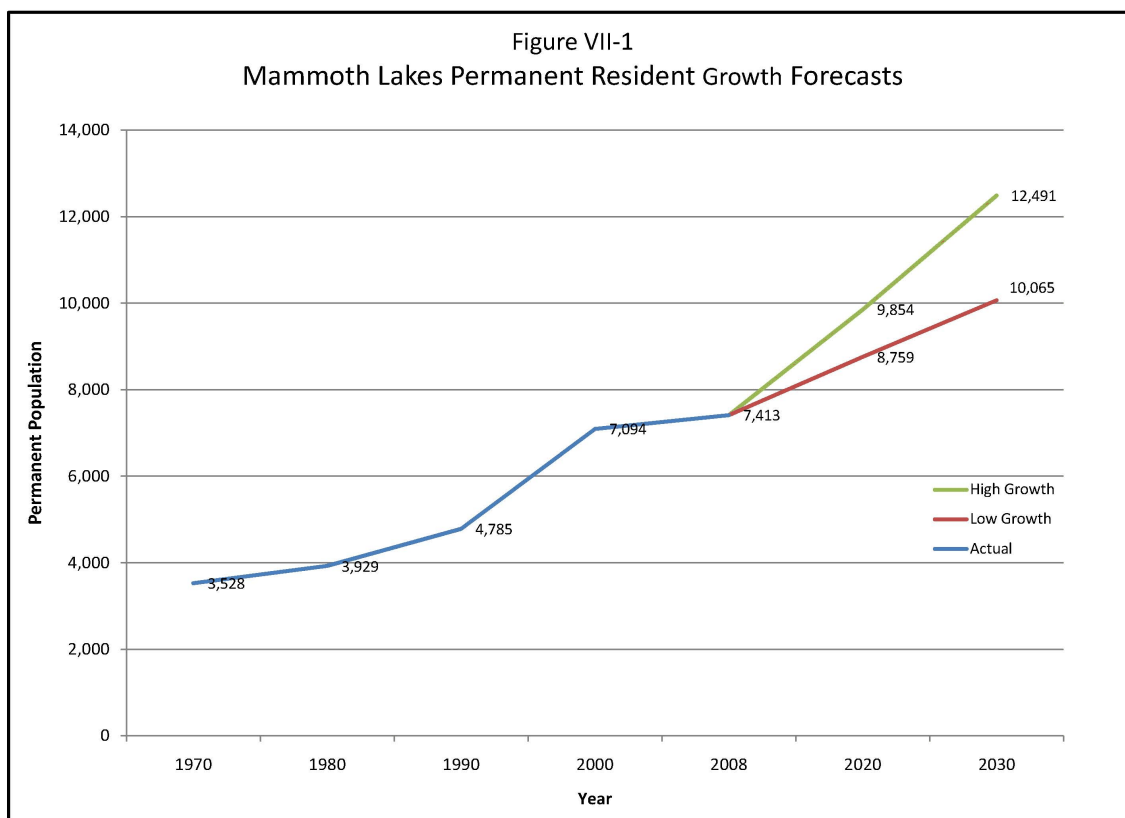


Table VII-2 compares the existing 2009 and 2030 land uses which are inputs to the model. The permanent resident population growth for the base future model is more consistent with the low growth scenario of 1.4 percent per year or 36 percent total growth by 2030.

The future land use table shows the most growth in the categories of high-density residential (visitor), lodging (standard hotels), and resort hotels. Consistent with the General Plan expectations, not all of the visitor housing and lodging is expected to be skier-related. This is observable with the skier population growing by 18 percent, whereas the visitor housing and lodging is growing at 47 percent to 262 percent.

Other categories of land use show no forecast growth. Employment and land use related to utilities, K-12 schools, colleges, government, and ski-industry employees are all expected to remain at 2009 levels. Please note that the schools, college, and government employees are kept at 2009 levels because they do not typically produce trips on a winter Saturday.

The land uses, when applied in the trip generation portion of the model, generate a future estimate of 368,192 trips per day, as seen in Table VII-3. No changes in trip rates are assumed. The total number of trips represents an increase of 36.9 percent in trips between 2009 and 2030. The table also shows that the overall annualized growth in trips is expected to be 1.5 percent per year, slightly faster than the growth in permanent resident population. Skier-related trips are expected to grow most slowly, at under one percent per year, while shopping and other non-work trips are expected to grow at 1.7 percent to 2.0 percent per year.

Table VII-2 Total Land Uses By Land Use Code: 2009 vs. 2030					
Land Use Code	Description of Land Use	Units	2009	2030	% Change
1	Residential Low Density (SF) - Resident	DUs	1,454	1,925	32%
3	Residential High Density (MF) - Resident	DUs	4,023	5,416	35%
4	Mobile Home Park - Resident	DUs	132	132	0%
5	Residential Low Density (SF) - Visitor	DUs	627	700	12%
7	Residential High Density (MF) - Visitor	DUs	2,426	3,563	47%
10	Lodging (Hotel) - Visitor	Room	997	2,574	158%
11	Resort Hotel - Visitor	Room	976	3,529	262%
13	Retail/Commercial	KSF	1,305	1,828	40%
21	Light Industrial	KSF	311	422	36%
23	Public Utility	Acres	49	49	-1%
31	Public School	Acres	832	832	0%
32	High School	Acres	314	314	0%
33	College	Student	0	0	0%
34	Hospital	Bed	21	33	57%
36	Post Office	PRS	7,402	7,400	0%
37	Church	Acres	14	14	0%
39	Downhill Skiing-Employees	Employee	2,163	2,163	0%
40	Downhill Skiing-Skiers	SAOTS	24,000	28,350	18%
41	Cross-Country Skiing/Snowmobiling	SAOTS	350	350	0%
<i>Source: Town of Mammoth Lakes, 2009.</i> <i>Notes: DU = Dwelling Unit, KSF = Thousand Square Feet, PRS = postal receptacles (mailboxes), SAOTS = skiers at one time.</i>					

Table VII-3 Balanced Daily Person-Trips by Trip Purpose: 2009 vs. 2030					
Trip Purpose	2009 Balanced Total Trips	2030 Balanced Total Trips	Numerical Increase	Percent Increase	Annualized Growth Rate
Home-Based Recreation	95,324	114,707	19,383	20.3%	0.89%
Home-Based Shopping	40,540	57,588	17,048	42.1%	1.69%
Home-Based Work	19,998	26,642	6,644	33.2%	1.38%
Home-Based Other	59,124	89,589	30,465	51.5%	2.00%
Other-to-Other	53,944	79,667	25,723	47.7%	1.87%
Total	268,930	368,192	99,262	36.9%	1.51%
<i>Source: LSC, 2010, sum of productions and attractions in balance.bin.</i>					

TRIP DISTRIBUTION

Table VII-4 presents the 2030 base future trip distribution results. The five largest trip interchanges are between the following pairs, listed in from/to order:

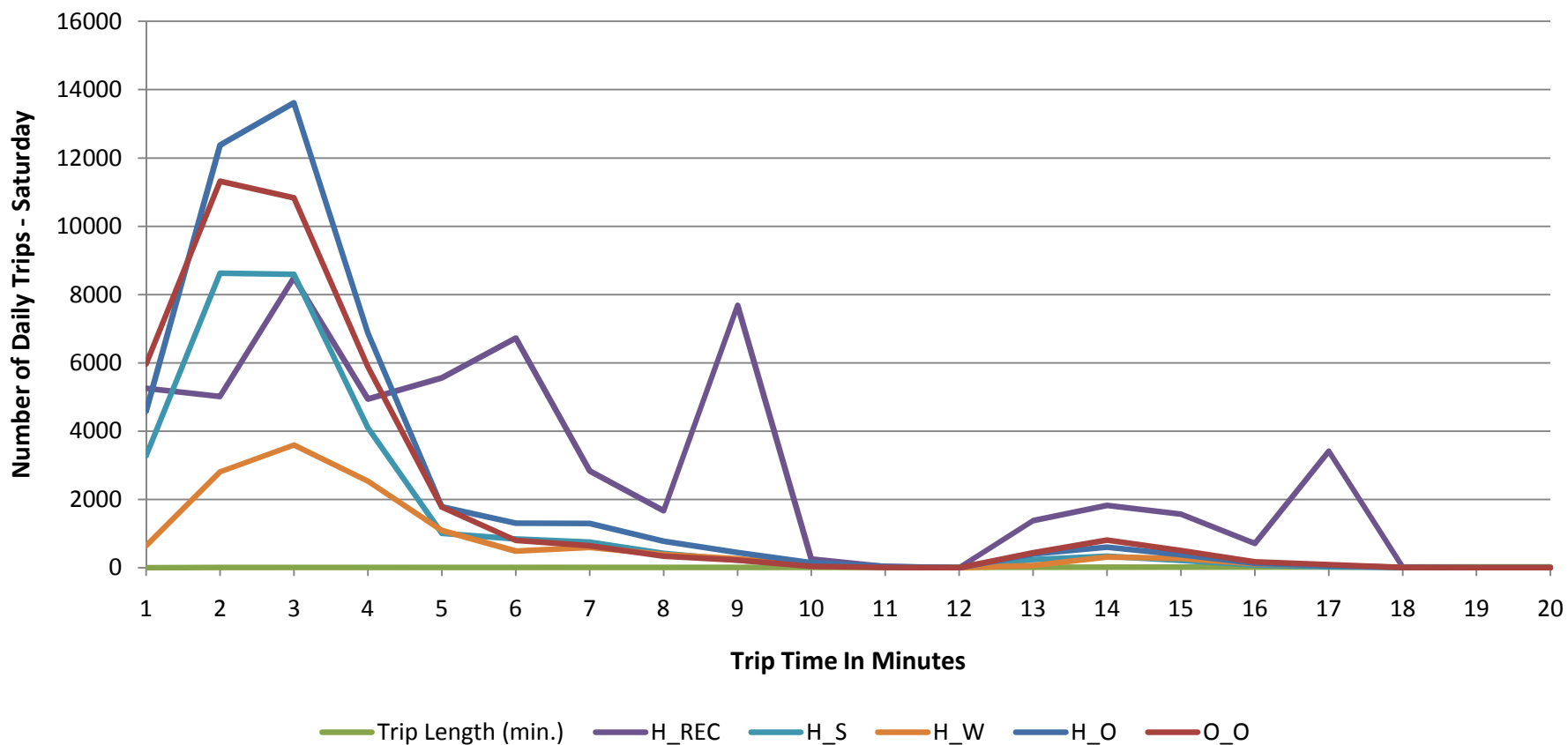
- North Village to North Village (3.1%)
- North Village to Old Mammoth Road (2.5%)
- Snowcreek to Old Mammoth Road (2.5%)
- External Stations to Main Lodge (4.0%)
- External Stations to North Village (2.3%)

The future trip distribution patterns change from the existing patterns. Trips are less concentrated in 2030 than in 2009. Table VII-5 shows the computed differences between the trip distribution tables. North Village sees the largest increase in trip making, both as an origin and a destination. The Main Street, Sierra Star, and Snowcreek districts also see substantial increases in trip making. Canyon Lodge is forecast to see some decreases in trip making over the same period. Most other districts remain stable or see very little increase in trip making.

Figure VII-2 shows the 2030 trip length frequency distribution for the five trip purposes. This chart indicates that the highest number of trips are about three minutes in duration. Most trips are under 10 minutes in duration. Both of these characteristics and the shape of the distribution curves match those of 2009. There is a slight increase in trips of 14 minutes in length, reflecting more trips from outlying neighborhood districts going to North Village. Overall, these results are consistent with the growth patterns implied by the planned land uses in 2030.

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**Figure VII-2
2030 Trip Length Frequency Distribution**

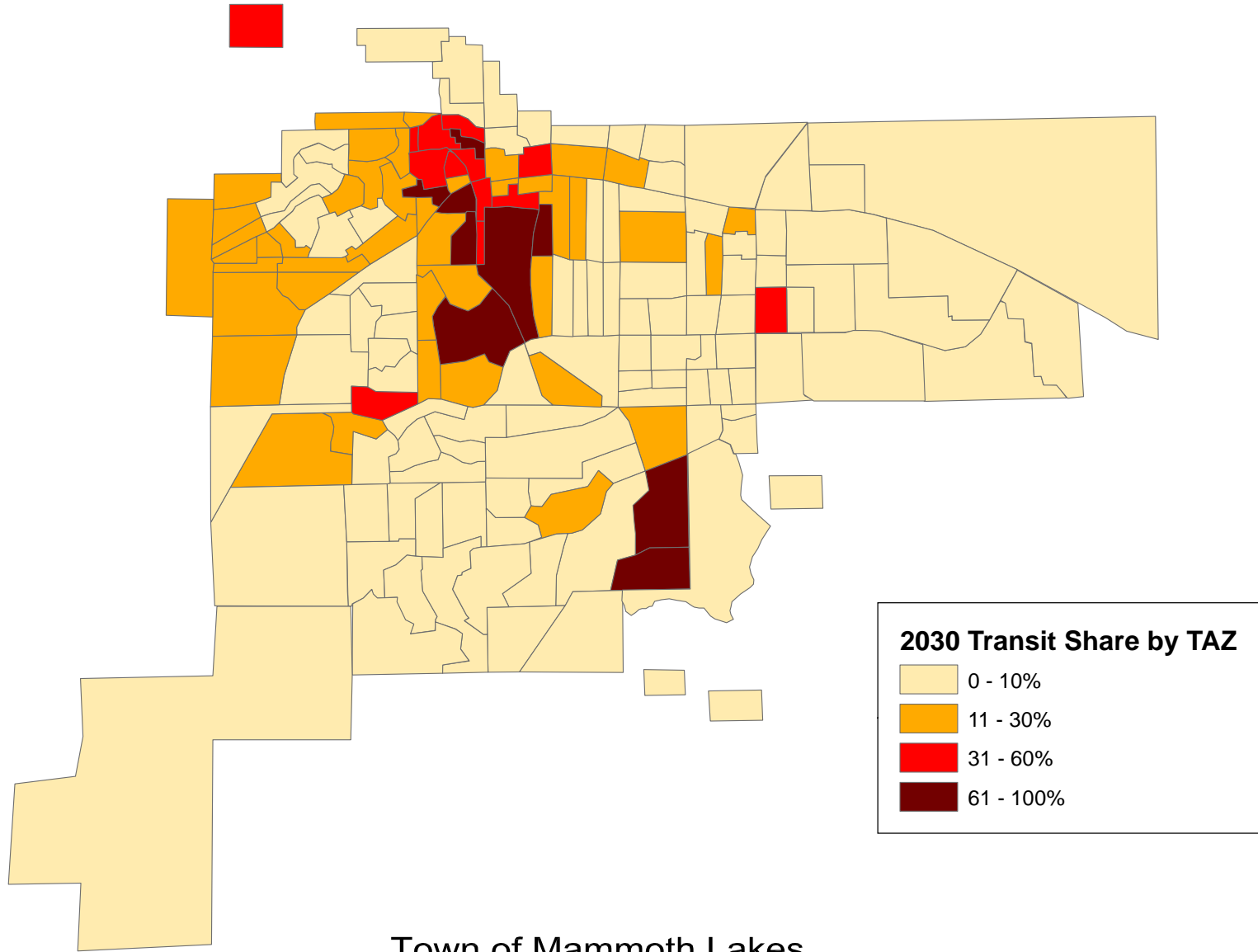


MODE SPLIT

The 2030 mode split by TAZ is mapped and shown in Figure VII-3. The transit share is high in the same locations as in 2009, including the four ski area gateways/portals and Main Street. There are also forecast transit mode share increases in the Sierra Star, Juniper Ridge, and Snowcreek neighborhood districts.

Overall, the transit share in 2030 is 18 percent for all trip purposes, with home-based recreation having the largest share at 36 percent. Table VII-6 shows the 2030 results by trip purpose. In comparison to the 2009 results, presented in an earlier chapter, there is a 1.6 percent increase in transit mode share for home-based recreation trips and 0.9 percent increase in transit mode share for home-based shopping trips. Other trip purposes hold steady or have negligible decreases in their transit mode share. These 2030 results show consistent patterns and reasonable shifts in transit mode share in comparison to 2009 results.

Table VII-7 shows the transit mode share at the four ski area portals. In comparison to 2009 results, volumes and transit shares for the Main Lodge and Canyon Lodge remain relatively unchanged. Although the Eagle Lodge and North Village see substantial increases in the number of transit trips, the persons in vehicles increases a greater amount, resulting in a decrease in transit mode share for those two ski area portals.



Town of Mammoth Lakes
2030 Transit Share by TAZ
Mammoth Lakes Model Update

Figure VII-3
LSC # 084870

Table VII-6 2030 Mode Choice By Trip Purpose					
Trip Purpose	Daily Person-Trips by Mode			Mode Split	
	Vehicle	Transit	Total	Vehicle	Transit
Home-Based Recreation	36,675	20,678	57,354	63.9%	36.1%
Home-Based Shopping	27,894	900	28,794	96.9%	3.1%
Home to Work	13,073	248	13,321	98.1%	1.9%
Home-Based Other	43,251	1,544	44,794	96.6%	3.4%
Other-to-Other	37,410	2,423	39,833	93.9%	6.1%
Totals	158,303	25,794	184,096	86.0%	14.0%
<i>Source: LSC, 2010.</i>					

Table VII-7 2030 Mode Choice at Ski Area Gateways (All Trip Purposes)						
Gateway	TAZ	Daily Person-Trips by Mode			Mode Split	
		Vehicle	Transit	Total	Vehicle	Transit
Main Lodge	1	10,040	5,243	15,284	65.7%	34.3%
Canyon Lodge	42	6,157	2,502	8,659	71.1%	28.9%
Eagle Lodge	130	5,422	1,901	7,323	74.0%	26.0%
North Village	28	4,683	1,942	6,625	70.7%	29.3%
<i>Source: LSC, 2010.</i>						

ASSIGNMENT

As was done for the existing base year, the same procedures were run on the future base year to assign trips to roadway links and transit routes. The following is a summary of the overall results for 2030:

- Total Vehicle-Trips = 84,417
- Daily Vehicle-Miles Traveled (VMT) = 179,708
- Daily Vehicle-Hours Traveled (VHT) = 13,761
- Average Vehicle Speed (mph) = 26.9

The above results are a key baseline for comparison of different future transportation scenarios. The daily average network speed drops slightly from 27.0 to 26.9 mph, which is expected given greater congestion during portions of the typical Saturday.

When the number of trips is divided into the VMT, the average trip distance is 2.1 miles. This 2030 result is 0.3 miles shorter than the 2009 existing base average of 2.4 miles. This is reflective of more short-distance trips being made within localized areas which see greater development (i.e., North Village).

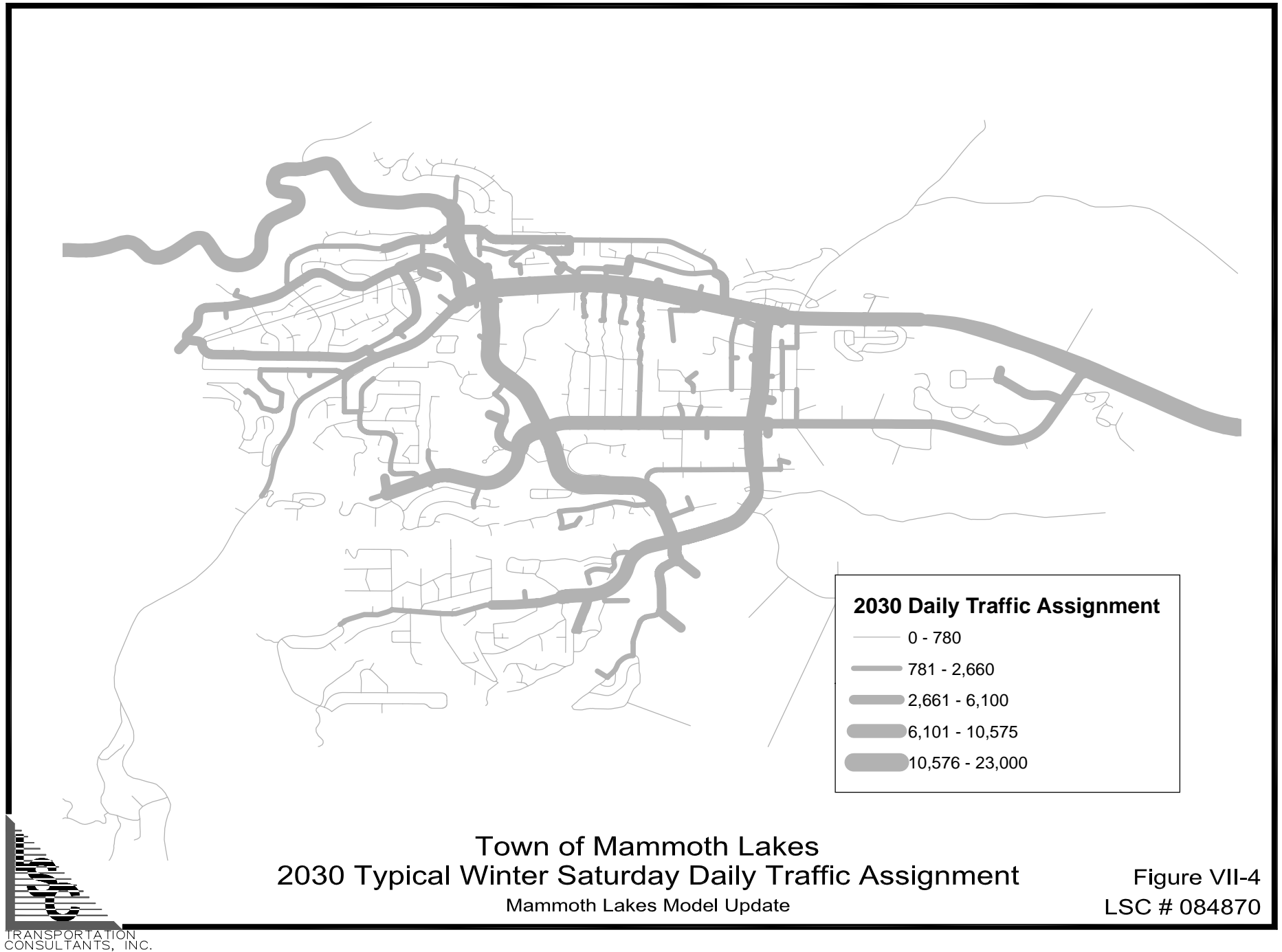
Future Traffic Assignment Results

Daily Traffic Assignment Results

Table VII-8 shows the two-way volumes on roadways throughout the Town of Mammoth Lakes. The table also compares existing base to future base volumes. Overall, roadway volumes are expected to increase 35 percent by 2030. On some roadways, the increases are more pronounced, such as on segments of Minaret Road, Old Mammoth Road, and Forest Trail.

Figure VII-4 presents the picture of traffic volumes along all roadway links. Most traffic continues to use streets that had high volumes in 2009.

Table VII-8 Daily Vehicular Assignment Comparison - Base vs. Future Buildout								
Link No.	Street Name	Actual Daily Volume	Existing Model Daily Volume	Error	Acceptable Error	Within Acceptable Error?	Future Model Daily Volume	Percent Change vs. Existing
17	Canyon Blvd.	3,730	3,943	5.7%	50%	Yes	3,898	-1%
30	Forest Trail	1,030	1,008	2.2%	50%	Yes	1,842	83%
33	Forest Trail	630	1,260	100.0%	100%	Yes	1,535	22%
55	Lake Mary Road	6,250	4,783	23.5%	25%	Yes	5,143	8%
167	Minaret Road	4,750	4,664	1.8%	25%	Yes	11,466	146%
186	Forest Trail	2,510	3,626	44.5%	50%	Yes	4,628	28%
206	Sierra Park Road	1,180	1,381	17.1%	50%	Yes	940	-32%
224	Minaret Road	4,150	4,212	1.5%	25%	Yes	10,058	139%
326	Davison Road	760	1,284	69.0%	100%	Yes	1,769	38%
350	Chateau Road	1,270	1,297	2.1%	50%	Yes	1,288	-1%
361	Meridian Blvd.	6,070	6,304	3.9%	25%	Yes	11,306	79%
376	Old Mammoth Road	4,830	5,019	3.9%	25%	Yes	7,371	47%
377	Old Mammoth Road	4,720	5,019	6.3%	25%	Yes	7,371	47%
397	Kelley Road	1,500	2,068	37.9%	50%	Yes	2,468	19%
415	Main Street	13,080	14,450	10.5%	15%	Yes	15,349	6%
467	Minaret Road	9,580	9,396	1.9%	25%	Yes	9,875	5%
468	Forest Trail	1,080	1,490	38.0%	50%	Yes	5,248	252%
511	Meridian Blvd.	4,900	5,029	2.6%	25%	Yes	8,040	60%
525	Sawmill Cutoff Road	350	72	79.3%	100%	Yes	59	-18%
541	Minaret Road	6,980	6,306	9.6%	25%	Yes	15,240	142%
552	Highway 203	3,670	3,925	7.0%	50%	Yes	4,395	12%
557	Mammoth Scenic Loop	240	286	19.3%	100%	Yes	318	11%
602	Old Mammoth Road	10,250	9,012	12.1%	15%	Yes	12,435	38%
621	Highway 203	4,010	4,288	6.9%	25%	Yes	4,686	9%
622	Highway 203	4,010	4,288	6.9%	25%	Yes	4,686	9%
37165198	Highway 203	3,670	3,924	6.9%	50%	Yes	4,392	12%
37165202	Meridian Blvd.	2,780	3,481	25.2%	50%	Yes	4,608	32%
37165216	Chateau Road	1,480	1,679	13.5%	50%	Yes	1,440	-14%
37165365	Berner Street	170	187	10.0%	100%	Yes	2,145	1047%
37165374	Minaret Road	7,910	9,292	17.5%	25%	Yes	13,219	42%
37165376	Canyon Blvd.	6,630	8,182	23.4%	25%	Yes	9,376	15%
37165509	Highway 203	6,530	7,988	22.3%	25%	Yes	8,844	11%
37165517	Main Street	16,560	17,825	7.6%	10%	Yes	20,195	13%
37165544	Lake Mary Road	2,100	1,131	46.1%	50%	Yes	1,182	5%
37165559	Old Mammoth Road	5,200	6,477	24.5%	25%	Yes	8,277	28%
37165589	Meridian Blvd.	2,590	3,192	23.2%	50%	Yes	4,436	39%
37165631	Meridian Blvd.	6,470	6,731	4.0%	25%	Yes	7,894	17%
37165644	Old Mammoth Road	10,590	10,326	2.5%	15%	Yes	12,071	17%
Total		174,210	184,829	6.1%			249,494	35%
Total for Key Roadways		122,530	127,864	4.4%				
Source: LSC, 2010.								



Peak-Hour Traffic Assignment Results

Table VII-9 shows the two-way peak-hour volumes on roadways throughout the Town of Mammoth Lakes. The table also compares existing base to future base volumes in the peak hour. Overall, peak-hour volumes are expected to increase 35 percent by 2030. Portions of Meridian Boulevard are forecast to experience 35 to 64 percent increases in peak-hour traffic volumes. Portions of Minaret Road are forecast to experience 89 to 131 percent increases in peak-hour traffic volumes. Several segments of Old Mammoth Road are forecast to experience 47 to 58 percent increases in peak-hour traffic volumes.

Figure VII-5 presents the picture of peak-hour traffic volumes along all roadway links.

<p align="center">Table VII-9 Peak-Hour Vehicular Assignment Comparison - Base vs. Future Buildout</p>								
Link No.	Street Name	Actual Peak-Hour Volume	Existing Model Peak-Hour Volume	Error	Acceptable Error	Within Acceptable Error?	Future Model Peak-Hour Volume	Percent Change vs. Existing
17	Canyon Blvd.	438	530	21.1%	50%	Yes	602	14%
30	Forest Trail	157	227	44.6%	50%	Yes	289	27%
33	Forest Trail	81	18	77.9%	100%	Yes	24	34%
55	Lake Mary Road	420	359	14.5%	25%	Yes	364	1%
160	Main Street	830	1,026	23.6%	25%	Yes	1,077	5%
167	Minaret Road	475	449	5.4%	25%	Yes	1,040	131%
168	Minaret Road	1,035	908	12.3%	15%	Yes	1,267	40%
169	Minaret Road	810	774	4.4%	25%	Yes	1,335	72%
177	Sierra Park Road	155	232	49.5%	50%	Yes	128	-45%
179	Tavern Road	99	105	5.8%	100%	Yes	162	55%
186	Forest Trail	340	402	18.3%	50%	Yes	446	11%
200	Tavern Road	59	29	50.1%	100%	Yes	35	19%
206	Sierra Park Road	123	164	33.2%	50%	Yes	121	-26%
212	Meridian Blvd.	810	768	5.1%	25%	Yes	791	3%
224	Minaret Road	389	440	13.1%	25%	Yes	930	111%
326	Davison Road	76	85	12.4%	100%	Yes	127	49%
328	Lake Mary Road	1,136	1,145	0.8%	15%	Yes	1,485	30%
349	Meridian Blvd.	470	375	20.1%	25%	Yes	614	64%
350	Chateau Road	117	75	36.0%	50%	Yes	98	31%
361	Meridian Blvd.	606	618	1.9%	25%	Yes	922	49%
376	Old Mammoth Road	548	519	5.2%	25%	Yes	761	47%
377	Old Mammoth Road	472	519	10.0%	25%	Yes	761	47%
441	Lake Mary Road	374	350	6.3%	50%	Yes	405	16%
467	Minaret Road	1,001	893	10.8%	25%	Yes	935	5%
468	Forest Trail	157	171	9.2%	50%	Yes	232	36%
472	Main Street	1,411	1,457	3.3%	15%	Yes	2,029	39%
512	Meridian Blvd.	488	458	6.1%	25%	Yes	693	51%
525	Sawmill Cutoff Road	35	11	67.2%	100%	Yes	9	-19%
541	Minaret Road	717	781	8.9%	25%	Yes	1,477	89%
557	Mammoth Scenic Loop	22	29	33.7%	100%	Yes	33	11%
602	Old Mammoth Road	846	737	12.9%	15%	Yes	1,162	58%
37165216	Chateau Road	148	98	34.0%	50%	Yes	101	3%
37165325	Lake Mary Road	372	370	0.5%	50%	Yes	504	36%
37165327	Lake Mary Road	1,293	1,184	8.4%	15%	Yes	1,709	44%
37165692	Old Mammoth Road	1,015	942	7.2%	15%	Yes	1,231	31%
37165365	Berner Street	26	27	4.3%	100%	Yes	152	460%
37165370	Minaret Road	955	813	14.9%	15%	Yes	1,002	23%
37165376	Canyon Blvd.	662	776	17.3%	25%	Yes	994	28%
37165415	North Majestic Pines Drive	147	172	17.1%	50%	Yes	188	9%
37165517	Main Street	1,413	1,412	0.1%	10%	Yes	1,656	17%
37165531	Main Street	1,440	1,400	2.8%	15%	Yes	1,732	24%
37165544	Lake Mary Road	223	138	38.1%	50%	Yes	145	5%
37165559	Old Mammoth Road	529	595	12.5%	25%	Yes	760	28%
37165573	Meridian Blvd.	726	813	12.0%	25%	Yes	1,096	35%
37165589	Meridian Blvd.	234	304	30.1%	50%	Yes	465	53%
37165634	Meridian Blvd.	756	714	5.6%	25%	Yes	703	-1%
37165644	Old Mammoth Road	897	828	7.7%	15%	Yes	1,091	32%
37165670	Minaret Road	910	1,134	24.6%	25%	Yes	1,715	51%
Total		26,443	26,377	0.2%			35,603	35.0%
Source: LSC, 2010.								

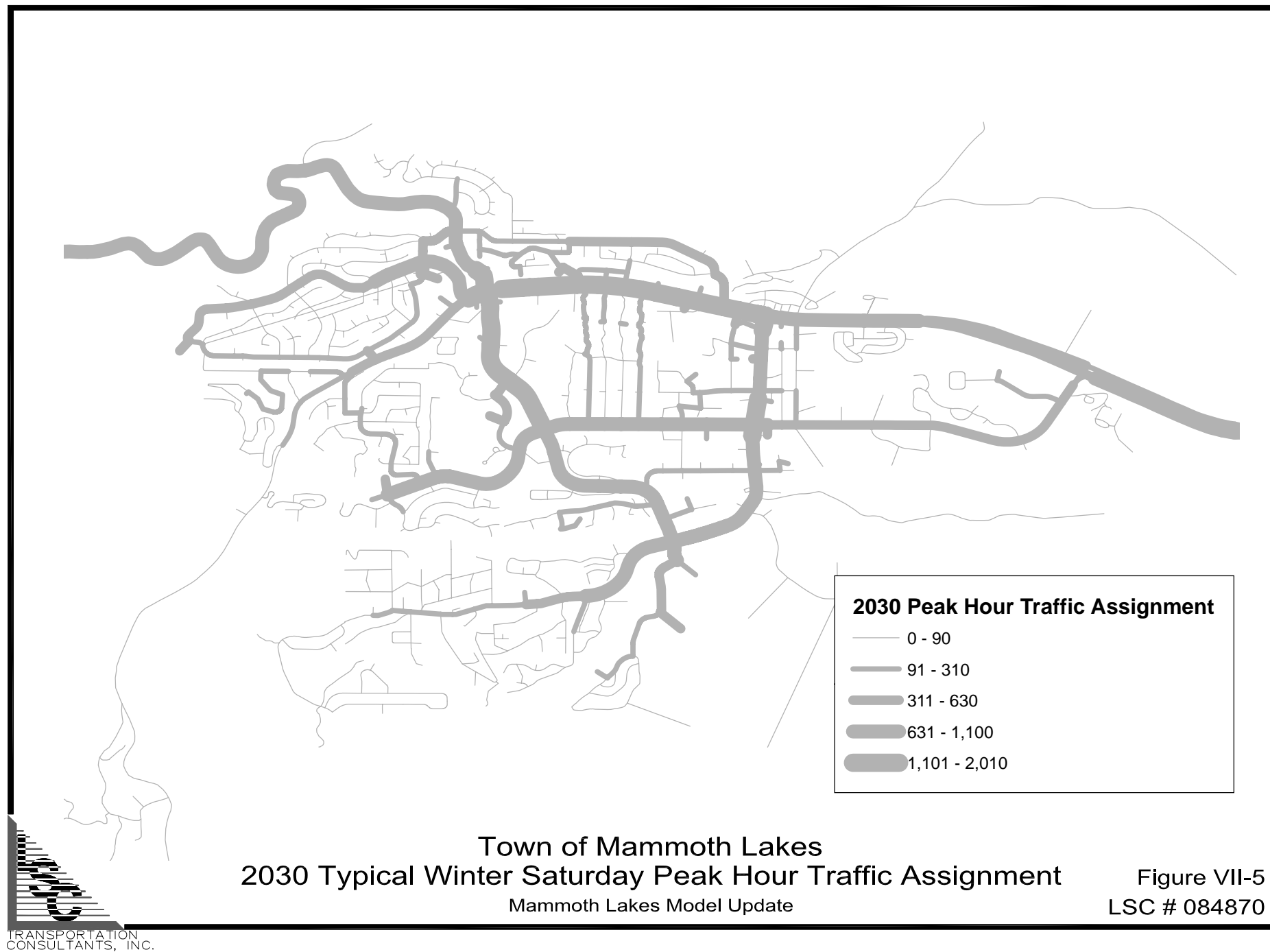


Figure VII-5
LSC # 084870

Future Transit Assignment

Table VII-10 shows a comparison of existing base (2009) and future base (2030) transit assignment results. Like traffic volumes, transit trips are expected to increase 35 percent overall by 2030. The Green Line—with service between Old Mammoth Road and Eagle Lodge along Meridian Boulevard—is expected to see a greater than average increase in ridership by 2030. The Red Line and Yellow Line will see an average increase in ridership by 2030, serving the North Village area. The results suggest that there may be a shift from bus to gondola between North Village, through Mammoth Slopes, and reaching the Canyon Lodge.

Table VII-10 Transit Boarding Comparison - Base vs. Future Buildout					
Route	Actual Boardings	Existing Model Boardings	Percent Error	Future Model Boardings	Percent Change vs. Existing
Red Line	6,700	6,710	0.1%	9,160	36.5%
Green Line	1,800	1,370	23.9%	2,450	78.8%
Blue Line	2,400	1,240	48.3%	990	-20.2%
Yellow Line	800	1,250	56.3%	1,680	34.4%
Orange	100	210	110.0%	220	4.8%
Mid-Town Lift	n/a	330		250	-24.2%
Gondola	n/a	2,740		3,090	12.8%
Total	11,800	10,780	8.6%	14,500	34.5%
<i>Source: LSC, 2010.</i>					

SUMMARY

The following summarizes the findings of the future year model validation:

- Permanent resident population is estimated to grow 36 percent by 2030.
- Total trips made by residents and visitors is forecast to grow 37 percent.
- North Village sees the largest increase in trip making.
- Main Street, Sierra Star, and Snowcreek districts also see substantial increases in trip making.
- Vehicular and transit volumes are both forecasted to increase 35 percent.
- Because lower-occupancy vehicle-trips increase more than high-occupancy trips, there will be little outward sign of a shift from vehicle to transit use.

- Meridian Boulevard, Minaret Road, and Old Mammoth Road are forecast to see the highest increases in peak-hour traffic volumes.
- The Green Line—with service along Meridian Boulevard—is expected to have the highest growth in transit volumes.
- Based on the results, there is a forecast shift from bus to gondola ridership in the area between North Village and Canyon Lodge.

Overall the model processes future land uses, trips, and assigns them to the network in expected proportions compared to the existing base (2009) model. These results indicate the model is performing as it should and is ready to be used to test future land use and transportation network scenarios.



CHAPTER VIII

Future Scenario Results

This chapter presents the results of the future base-year model discussed in the previous chapter and analysis of several variations/enhancements to the base-year model representing some future alternatives. The base-year model represents the loading of additional trips to be generated by the anticipated future land uses to the **current** transportation system. The overall purpose of this project is to use a calibrated model to forecast future traffic volumes and levels of congestion and to evaluate alternatives. As the future base model does not include any transportation system capacity improvements, enhancements, or other changes, it is essentially the “do-nothing” alternative. The only exception to this is the addition of Snowcreek transit. This extension of the red line into Snowcreek (down to TAZs 160 and 161) was included in the future base model since it is a requirement of Snowcreek to add this extension.

As stated in Chapter I, the purpose of this modeling effort is to be able to test and assess changes to the land use and transportation system, and to thereby inform decision-makers for the benefit of the Town of Mammoth Lakes. The model is designed and intended to assist in making the types of decisions that go beyond site-level traffic impact studies usually required as part of the development review process.

The future base model results present a scenario useful in identifying areas of congestion that may occur if land use and trip generation increase without any expansion or increase in the carrying capacity of the transportation system (with the exception of the addition of Snowcreek transit). The results presented in this chapter also show the existing conditions for comparison to forecasted future conditions.

The analysis of several scenarios or alternatives to the future base-model alternative has been performed to identify the relative effectiveness of each in miti-

gating or minimizing further degradation of level of service of congested streets and intersections identified in the existing and future base-year model. Two of the alternatives also present analysis of conditions with higher levels of development and trip generation in certain areas than used in the future base model combined expansion of the transportation system.

DESCRIPTION OF SCENARIOS/CHANGES TO THE FUTURE BASE MODEL

The following describes the five alternatives evaluated using modified versions of the Future Base Model. Table VIII-1 summarizes these descriptions.

Scenario 1

This scenario models the addition of new streets (to the future base model) expected to be implemented by Other Planned Development. These added streets are depicted in Figure VIII-1. Alternative 1 does not model all the new streets shown in this figure, only the salmon-colored streets that would be “new streets implemented by Other Planned Development.” This alternative also maintains the Main Street frontage roads. This scenario uses the same land use assumptions as the future base model.

Scenario 2

This scenario models the addition of new streets (to the future base model) recommended in the Downtown Neighborhood District Plan (DNDP)/Mobility Plan Complete Circulation Network. These added streets are depicted in Figure VIII-1. As in the case of Scenario 1, this alternative also maintains the Main Street frontage roads and uses the same land use assumptions as the future base model.

Scenario 3

Scenario 3 is the same as Scenario 2 with the exception of the Main Street frontage roads. These have been removed in the Scenario 3 model. As with the previous two scenarios, the same land use assumptions as the future base model were used.

<div> <div>Table VIII-1</div> <div>Buildout Traffic Model Alternatives for LSC Contract</div> </div>					
Alt.		Description	Future Roadway Network	Future Land Use Assumptions	Other Assumptions
X	Buildout “Baseline” + Existing Network	<p>This alternative models buildout with the existing roadway network.</p> <p>Land use assumptions are based on PAOT and traffic model for residential uses and commercial/industrial land uses.</p>	Existing network	<ul style="list-style-type: none"> Residential: use PAOT assumptions for units and rooms. Commercial: Approved projects + 0.25 FAR for vacant/redevelopment land in CG/CL zones Industrial: 0.9 FAR for vacant land in Industrial zone 	Transit share = 14%
1	Buildout “Baseline” + “Future Development Roads”	<p>This alternative models the existing roadway network plus roads that are reasonably expected to be built with future development. (The frontage roads are maintained in this alternative.)</p> <p>Land use assumptions are the same as above.</p>	Existing network plus Future Development Roads	Same as above	Transit share = 14%
2	Buildout “Baseline” + “Complete Circulation Network”	<p>This alternative models the existing roadway network plus roads that are recommended in the DNDP/Mobility Plan Complete Circulation Network. (The frontage roads are maintained in this alternative.)</p> <p>Land use assumptions are the same as above.</p>	Existing network plus “Complete Circulation Network”	Same as above	Transit share = 14%
3	Buildout “Baseline” + “Complete Circulation Network” (No Frontage Roads)	<p>This alternative models the existing roadway network plus roads that are recommended in the DNDP/Mobility Plan Complete Circulation Network. The frontage roads are removed in this alternative.</p> <p>Land use assumptions are the same as above.</p>	Existing network plus “Complete Circulation Network” – Frontage Roads	Same as above	Transit share = 14%
4	Buildout “DNDP” + “Complete Circulation Network” (No Frontage Roads)	<p>This alternative models the existing roadway network plus roads that are recommended in the Mobility Plan/DNDP Complete Circulation Network. The frontage roads are removed in this alternative.</p> <p>Land use assumptions are increased from the alternatives above to include rooms/units and commercial space possible under the DNDP.</p>	Existing network plus “Complete Circulation Network” minus Frontage Roads	<ul style="list-style-type: none"> Additional units/rooms and commercial square footage available due to ROW relinquishment in DNDP Study Area (4 acres/175,000 sq. ft. additional) between Manzanita and Sierra Park). <ul style="list-style-type: none"> Residential: Additional 320 rooms possible at 80 rpa Commercial (CG/CL): 175,000 sq. ft additional. Need to determine appropriate FAR. RV Park – New Sports/Events Park FS Compound – New Civic Center, Retail and MF Res units <ul style="list-style-type: none"> 30,000 sq. ft. additional retail 82 MF units Industrial: 0.9 FAR for vacant land in Industrial zone 	Transit share = 14%
5	Buildout “DNDP ” + “Complete Circulation Network” (No Frontage Roads) + Increased Transit	<p>Roadway network is the same as Alternative 4, but transit ridership is increased.</p> <p>Land use assumptions are the same as Alternative 4.</p>	Same as Alternative 4 with additional transit	Same as Alternative 4	Transit Share = 17%

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PREFERRED ALTERNATIVE: CIRCULATION NETWORK

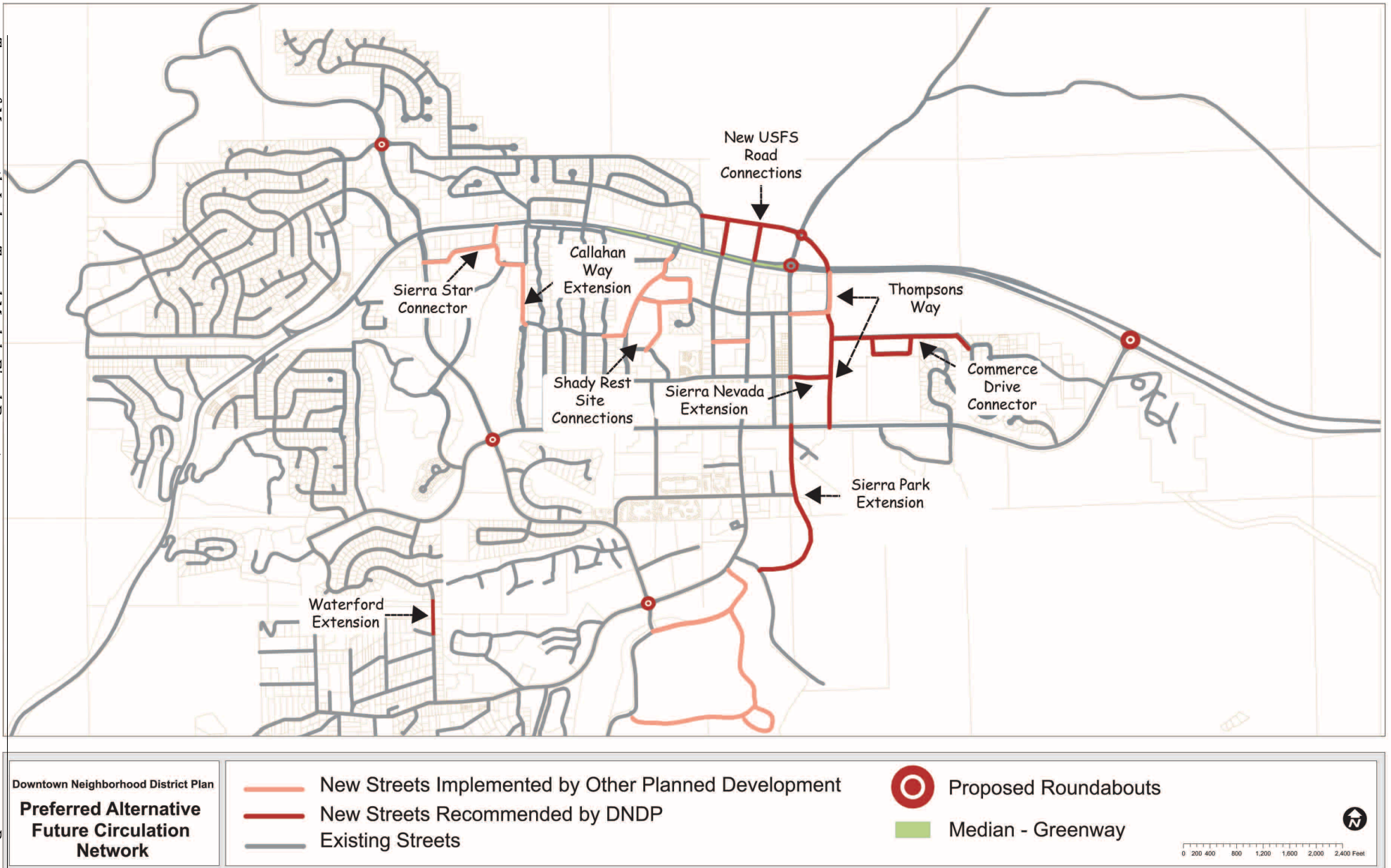


Figure VIII-1
Future Circulation Network

Scenario 4

Scenarios 4 considers land use changes to the future base model assumptions to include rooms/units and commercial space possible under the DNDP. Table VIII-1 presents a summary of the land use assumptions and land use quantities. Appendix D includes more detailed information regarding the assumptions.

The land-use changes include:

- Relatively modest increases in land use along Main Street between the RV park and Mountain Boulevard area associated with the assumptions/recommendations of the DNDP involving right-of-way (ROW) relinquishment, which frees up approximately four acres of additional land.
- Recommendations for a sports/event park on the site of the current RV park and Town/County property (TAZs 87 and 90).
- The recommended addition of a Civic Center and employee housing on the existing Forest Service compound/campground (TAZs 38 and 39). For the Civic Center and sports/events park, it is assumed that these uses would not be very productive on the design day (winter Saturday) so a small amount of retail has been added as a proxy.

In addition to the land use changes, this scenario models the addition of new streets that are recommended in the DNDP/Mobility Plan Complete Circulation Network to the future base model. These added streets are depicted in Figure VIII-1. As with Scenario 3, this alternative also assumes the removal of the front-age roads.

Scenario 5

Scenario 5 is the same as Scenario 4 with the exception of an increased transit ridership assumption. Alternative 5 adds the transit route between Snowcreek and Main Lodge along Minaret referred to as the “Orange Line.” Stops were modeled within Snowcreek, at Meridian, near the Village, and at Main Lodge line from Snowcreek to the village and then the Main Lodge. The model generated ridership along this route of approximately 2,000 passengers per day. The overall transit mode split for this scenario rose from 14 percent in previous scenarios to 17 percent in Scenario 5.

MODEL RESULTS

The modeled results of the existing, future base model, and Scenarios 1 through 5 are summarized in Tables VIII-2 and VIII-3. Results are expressed in terms of street segment/link volume, segment volume-to-capacity ratios, and intersection level of service for signalized intersections and critical approaches at unsignalized intersections.

Peak-Hour Link Volumes and Volume-to-Capacity Ratios

Table VIII-2 contains the study street segment model-forecasted peak-hour volumes (per lane, single direction of travel) and corresponding volume-to-capacity ratios for the existing condition, future baseline condition, and future conditions for each of the five modeled alternatives. The specific street segments are identified by the “link number” shown in the first column of the table. For reference, a printout of the model showing the street network and corresponding link numbers is contained in the appendix. Streets such as Minaret Road appear in multiple rows in the table as the street has been broken into separate segments with separate link numbers for analysis purposes.

The assumed capacity of segments used in this calculation is based on the facility type of the street segment. These capacity values are identified in Table II-1 “Road Network Characteristics.” Volume-to-capacity ratios of 1.0 or greater have been highlighted in the table to indicate that the model-forecasted volume is equal to or greater than the assumed capacity. Generally, the higher the volume-to-capacity ratio, the greater the level of congestion. Although this report assigns a capacity value based on facility type/functional classification, individual street capacities vary depending on characteristics, including on-street parking, street width, number of driveways, spacing of intersections, horizontal and vertical alignment, auxiliary turn lanes, and medians. In urban areas, intersection level of service/capacity analysis is often a better indicator of the capacity limitations of the network, as intersections tend to control the capacity with most of the delay and congestion occurring at them. However, street segment volume-to-capacity ratios give a general indication if a street is forecasted to carry traffic levels at or above the generally accepted hourly, industry-recommended volumes.

Peak-Hour Intersection Level of Service

Table VIII-3 presents calculated peak-hour intersection level of service (LOS).

The level of service values corresponding to the signalized intersections identified in the top part of the table under the heading “Signalized” represent the levels of service for the entire intersection.

The level of service values corresponding to the unsignalized intersections identified in the bottom part of the table under the heading “Unsignalized” represent the levels of service for the “critical approaches” at the unsignalized intersections analyzed. For example, LOS F is listed for the Old Mammoth Road/Chateau Road intersection under Alternative 1. This level of service applies to the eastbound approach only. The westbound approach is LOS C, and the northbound and southbound left-turn movements are LOS A. The intersection volume worksheets and Synchro models for each alternative are also attached.

In addition to the LOS rating, Table VIII-3 includes the overall average delay values (seconds per vehicle) for the signalized intersections and average critical approach delay (seconds per vehicle) values for the unsignalized intersections. For those unsignalized intersections where the Level of Service is “F,” the approach volume-to-capacity ratio is shown instead of the delay since it is a better relative measure for comparison of how the intersection approach would operate. In Synchro, once the movement or approach delays exceed 120 seconds per vehicle, they tend to increase exponentially and provide unrealistic results. The volume-to-capacity ratios provide a better measure for comparison of scenarios and an indication of how far above capacity the expected demand will be.

The level of service values of “F” do not necessarily indicate definitive “failure” of the intersection, or even the critical approach. It is simply a calculation of the estimated average delay per vehicle during the Saturday peak hour. The level of service values in the “E” and “F” ranges and volume-to-capacity ratios identify potential intersection approaches which may require closer monitoring or evaluation to determine if mitigation will become necessary. LSC recommends considering the approach volume of traffic for which the level of service applies. Site-

specific conditions should be considered, such as nearby traffic signals that may cause gaps in traffic allowing side street traffic to enter the intersection with lower average delay than Synchro LOS analyses. Also, consideration should be given to available alternatives to those intersections with high delay approaches, as there may be alternate routes available to motorists that do not include a high-delay left turn or through movement from a stop-sign-controlled intersection approach.

Alternative 3 provides the best overall performance for all of the analyzed intersections and does not have any volume-to-capacity ratios above 3.00. The total delay is significantly lower than some of the other alternatives.

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<div>Table VIII-2</div> <div>Future Alternatives Comparison - Segment Capacity</div>																			
Link No.	Street Name	from	to	Capacity	Existing			Base Future		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
					Peak-Hour Volume	Model Peak-Hour Volume	Volume/Capacity Ratio	Peak-Hour Volume	Volume/Capacity Ratio	Peak-Hour Volume	Volume/Capacity Ratio	Peak-Hour Volume	Volume/Capacity Ratio	Peak-Hour Volume	Volume/Capacity Ratio	Peak-Hour Volume	Volume/Capacity Ratio	Peak-Hour Volume	Volume/Capacity Ratio
17	Canyon Blvd.	Lakeview Blvd.	Forest Trail	500	438	634	1.27	619	1.24	567	1.13	625	1.25	593	1.19	606	1.21	578	1.16
30	Forest Trail	Sierra Blvd.	Rusty Ln.	500	157	174	0.35	336	0.67	287	0.57	342	0.68	309	0.62	329	0.66	320	0.64
33	Forest Trail	Crest Ln.	Forest Pl.	500	81	20	0.04	24	0.05	51	0.10	83	0.17	75	0.15	75	0.15	70	0.14
55	Lake Mary Road	Hidden Valley Rd.	Canyon Blvd.	800	420	327	0.41	396	0.50	367	0.46	318	0.40	352	0.44	378	0.47	369	0.46
160	Main Street	Old Mammoth Rd.	Sierra Manor Rd.	3,200	830	966	0.30	1,070	0.33	1,101	0.34	1,182	0.37	1,181	0.37	1,322	0.41	1,301	0.41
167	Minaret Road	Evening Star	Meridian Blvd.	1,400	475	430	0.31	993	0.71	1,019	0.73	896	0.64	907	0.65	893	0.64	831	0.59
168	Minaret Road	Main St.	Forest Trail	1,500	1,035	934	0.62	1,238	0.83	1,236	0.82	1,218	0.81	1,222	0.81	1,219	0.81	1,124	0.75
169	Minaret Road	Meridian Blvd.	E. Bear Lake Dr.	1,400	810	710	0.51	1,260	0.90	1,256	0.90	1,278	0.91	1,230	0.88	1,246	0.89	1,158	0.83
177	Sierra Park Road	Main St.	Tavern Rd.	500	155	198	0.40	119	0.24	136	0.27	204	0.41	214	0.43	263	0.53	247	0.49
179	Tavern Road	Old Mammoth Rd.	Laurel Mtn. Rd.	500	99	98	0.20	180	0.36	240	0.48	105	0.21	177	0.35	299	0.60	214	0.43
186	Forest Trail	Hillside Dr.	Minaret Rd.	500	340	423	0.85	479	0.96	423	0.85	447	0.89	446	0.89	416	0.83	405	0.81
200	Tavern Road	Old Mammoth Rd.	Sierra Manor Rd.	500	59	58	0.12	44	0.09	60	0.12	12	0.02	14	0.03	16	0.03	16	0.03
206	Sierra Park Road	Meridian Blvd.	Sierra Nevada Rd.	500	123	191	0.38	122	0.24	127	0.25	179	0.36	176	0.35	215	0.43	203	0.41
212	Meridian Blvd.	Azimuth Dr.	Old Mammoth Rd.	1,400	810	698	0.50	759	0.54	730	0.52	741	0.53	703	0.50	767	0.55	750	0.54
224	Minaret Road	Meadow Ln.	Old Mammoth Rd.	700	389	429	0.61	878	1.25	897	1.28	798	1.14	808	1.15	805	1.15	759	1.08
326	Davison Road	Lee Rd.	Lake Mary Rd.	400	76	85	0.21	125	0.31	124	0.31	159	0.40	149	0.37	156	0.39	153	0.38
328	Lake Mary Road	Canyon Blvd.	Minaret Rd.	1,600	1,136	1,211	0.76	1,454	0.91	1,499	0.94	1,450	0.91	1,451	0.91	1,542	0.96	1,423	0.89
349	Meridian Blvd.	Majestic Pines Dr.	N. Majestic Pines Dr.	1,400	470	391	0.28	696	0.50	695	0.50	690	0.49	688	0.49	689	0.49	658	0.47
350	Chateau Road	Minaret Rd.	Azimuth Dr.	500	117	73	0.15	102	0.20	108	0.22	89	0.18	91	0.18	96	0.19	93	0.19
361	Meridian Blvd.	Sierra Star Pkwy.	Minaret Rd.	1,400	606	622	0.44	985	0.70	1,013	0.72	920	0.66	929	0.66	960	0.69	914	0.65
376	Old Mammoth Road	Sherwin Creek Rd.	Chateau Rd.	700	548	536	0.77	783	1.12	760	1.09	683	0.98	661	0.94	732	1.05	719	1.03
377	Old Mammoth Road	Minaret Rd.	Sherwin Creek Rd.	700	472	536	0.77	783	1.12	584	0.83	585	0.84	615	0.88	690	0.99	679	0.97
440	Lake Mary Road	Davidson Rd.	Kelley Rd.	400	374	219	0.55	268	0.67	268	0.67	268	0.67	268	0.67	280	0.70	270	0.68
467	Minaret Road	Mammoth Knolls Dr.	Forest Trail	1,500	1,001	988	0.66	997	0.66	999	0.67	997	0.66	1,001	0.67	988	0.66	884	0.59
468	Forest Trail	Minaret Rd.	Berner St.	500	157	129	0.26	237	0.47	159	0.32	209	0.42	204	0.41	195	0.39	189	0.38
472	Main Street	Minaret Rd.	Mountain Blvd.	3,200	1,411	1,596	0.50	2,011	0.63	1,604	0.50	1,520	0.47	1,571	0.49	1,570	0.49	1,584	0.50
512	Meridian Blvd.	Majestic Pines Dr.	Lodestar Dr.	1,400	488	477	0.34	754	0.54	754	0.54	703	0.50	705	0.50	720	0.51	693	0.49
525	Sawmill Cutoff Road	Main St.	Ritter Rd.	400	35	12	0.03	10	0.02	23	0.06	0	0.00	0	0.00	0	0.00	0	0.00
541	Minaret Road	E. Bear Lake Dr.	Main St.	1,400	717	718	0.51	1,382	0.99	1,181	0.84	1,299	0.93	1,145	0.82	1,138	0.81	1,020	0.73
557	Mammoth Scenic Loop	Minaret Rd.		1,400	22	29	0.02	33	0.02	33	0.02	33	0.02	33	0.02	33	0.02	33	0.02
602	Old Mammoth Road	Meridian Blvd.	Oak Tree Way	1,200	846	852	0.71	1,179	0.98	1,152	0.96	1,084	0.90	1,006	0.84	1,120	0.93	1,096	0.91
37165216	Chateau Road	Azimuth Dr.	Old Mammoth Rd.	500	148	99	0.20	103	0.21	97	0.19	82	0.16	82	0.16	90	0.18	88	0.18
37165325	Lake Mary Road	Hidden Valley Rd.	Canyon Blvd.	800	372	337	0.42	520	0.65	491	0.61	442	0.55	476	0.60	507	0.63	496	0.62
37165327	Lake Mary Road	Canyon Blvd.	Minaret Rd.	1,600	1,293	1,251	0.78	1,678	1.05	1,724	1.08	1,674	1.05	1,675	1.05	1,778	1.11	1,654	1.03
37165365	Berner Street	Alpine Cir.	Forest Trail	400	26	29	0.07	162	0.41	159	0.40	161	0.40	153	0.38	152	0.38	148	0.37
37165370	Minaret Road	Main St.	Forest Trail	1,500	955	860	0.57	1,011	0.67	1,010	0.67	987	0.66	996	0.66	977	0.65	904	0.60
37165376	Canyon Blvd.	Hillside Dr.	Lake Mary Rd.	800	662	875	1.09	943	1.18	1,019	1.27	1,018	1.27	985	1.23	1,045	1.31	937	1.17
37165415	North Majestic Pines Drive	Monterey Pine Rd.	Meridian Blvd.	700	147	172	0.25	204	0.29	216	0.31	241	0.34	243	0.35	244	0.35	233	0.33
37165517	Main Street	Laurel Mtn. Rd	Old Mammoth Rd.	3,200	1,413	1,468	0.46	1,644	0.51	1,552	0.49	1,650	0.52	1,612	0.50	1,642	0.51	1,672	0.52
37165531	Main Street	Mountain Blvd.	Sierra Blvd.	2,800	1,440	1,518	0.54	1,774	0.63	1,982	0.71	1,906	0.68	1,942	0.69	2,141	0.76	2,061	0.74
37165544	Lake Mary Road	Lee Rd.	Davidson Rd.	500	223	134	0.27	143	0.29	145	0.29	109	0.22	119	0.24	124	0.25	117	0.23
37165559	Old Mammoth Road	Timber Creek Rd.	Minaret Rd.	700	529	594	0.85	762	1.09	762	1.09	691	0.99	691	0.99	718	1.03	703	1.00
37165573	Meridian Blvd.	Minaret Rd.	Obsidian Pl.	1,400	726	766	0.55	1,096	0.78	996	0.71	982	0.70	959	0.69	1,043	0.75	993	0.71
37165589	Meridian Blvd.	Commerce Dr.	Highway 203	700	234	328	0.47	448	0.64	448	0.64	456	0.65	455	0.65	460	0.66	461	0.66
37165634	Meridian Blvd.	Old Mammoth Rd.	Sierra Manor Rd.	1,400	756	699	0.50	684	0.49	669	0.48	574	0.41	537	0.38	548	0.39	539	0.39
37165644	Old Mammoth Road	Meridian Blvd.	Sierra Nevada Rd.	1,200	897	926	0.77	1,131	0.94	1,061	0.88	866	0.72	986	0.82	1,117	0.93	1,095	0.91
37165670	Minaret Road	E. Bear Lake Dr.	Main St.	1,400	910	982	0.70	1,681	1.20	1,322	0.94	1,257	0.90	1,222	0.87	1,385	0.99	1,098	0.78
37165692	Old Mammoth Road	Tavern Rd.	Main St.	1,200	1,015	1,105	0.92	1,211	1.01	1,140	0.95	765	0.64	718	0.60	723	0.60	772	0.64

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<div>Table VIII-3</div> <div>Future Alternatives Comparison - Intersection Level of Service Results⁽¹⁾</div>														
Intersection	Existing		Base Future		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Overall LOS	Overall Delay (sec./veh.)	Overall LOS	Overall Delay (sec./veh.)	Overall LOS	Overall Delay (sec./veh.)	Overall LOS	Overall Delay (sec./veh.)	Overall LOS	Overall Delay (sec./veh.)	Overall LOS	Overall Delay (sec./veh.)	Overall LOS	Overall Delay (sec./veh.)
Signalized														
Lake Mary Road/Canyon Boulevard	A	9.2	A	8.8	A	9.4	A	9.4	A	9.2	A	9.4	A	9.1
Main Street/Minaret Road	C	29.7	D	37.2	C	33.4	C	32.6	C	32.7	C	33.8	C	31.8
Main Street/Old Mammoth Road	B	14.3	B	14.8	B	14.5	B	14.1	B	14.0	B	14.0	B	14.2
Meridian Boulevard/Minaret Road	B	15.5	C	22.0	C	22.0	C	21.2	C	20.9	C	21.3	C	20.2
Meridian Boulevard/Old Mammoth Road	B	19.7	C	22.6	C	21.9	C	22.1	C	20.9	C	22.1	C	21.9
Unsignalized	Critical Approach LOS	Critical Approach Delay (sec./veh.) ⁽²⁾	Critical Approach LOS	Critical Approach Delay (sec./veh.) ⁽²⁾	Critical Approach LOS	Critical Approach Delay (sec./veh.) ⁽²⁾	Critical Approach LOS	Critical Approach Delay (sec./veh.) ⁽²⁾	Critical Approach LOS	Critical Approach Delay (sec./veh.) ⁽²⁾	Critical Approach LOS	Critical Approach Delay (sec./veh.)	Critical Approach LOS	Critical Approach Delay (sec./veh.)
Minaret Road/Forest Trail	F	0.37	F	1.24	F	0.94	F	1.02	F	1.03	F	0.91	F	0.76
Lake Mary Road/Davidson Road/Kelley Road	B	12.9	B	14.4	B	14.4	B	14.9	B	14.7	B	14.9	B	14.2
Main Street/Mountain Boulevard	D	32.2	F	1.30	F	2.25	F	1.85	F	2.67	F	> 7.00	F	5.64
Main Street/Center Street	D	31.9	F	1.19	F	7.60	F	6.75	F	1.44	F	1.66	F	1.55
Main Street/Forest Trail	F	1.17	F	2.09	F	1.74	F	1.68	F	1.88	F	2.76	F	2.42
Main Street/Laurel Mountain Road	F	0.87	F	1.46	F	1.08	F	0.87	F	0.94	F	1.86	F	1.37
Main Street/Sierra Park Road/Sawmill Cutoff	B	13.4	C	16.3	C	16.5	C	16.5	C	16.3	C	16.9	C	16.9
Old Mammoth Road/Tavern Road	C	23.9	E	47.9	F	0.55	C	23.8	D	28.6	F	0.60	D	34.6
Old Mammoth Road/Sierra Nevada Road	E	35.4	F	1.00	F	0.66	F	0.54	F	0.55	F	0.84	F	0.77
Meridian Boulevard/Majestic Pines Drive	B	11.0	B	14.4	B	14.2	B	14.0	B	14.0	B	14.1	B	13.8
Meridian Boulevard/Sierra Park Road	A	8.2	A	8.4	A	8.4	A	8.4	A	8.3	A	8.3	A	8.3
Old Mammoth Road/Chateau Road	C	18.6	F	0.67	F	0.59	D	32.0	D	30.6	E	42.7	E	40.3
Old Mammoth Road/Minaret Road	B	14.5	F	6.44	F	1.27	F	1.07	F	1.18	F	1.26	F	1.10
Notes: (1) Performed in the <i>Synchro</i> capacity analysis software using the 2000 <i>Highway Capacity Manual</i> methodology. (2) For unsignalized intersections with a Level of Service "F," critical approach volume-to-capacity ratio is reported instead of delay.														

Appendix A: Existing Land Uses



Existing Land Uses																				
TAZ	1	3	4	5	7	10	11	13	21	23	31	32	33	34	36	37	39	40	41	
	SF Resident	MF Resident	Mobile Home	SF Visitor	MF Visitor	Lodging Hotel	Resort Hotel	Retail/ Commercial	Light Industrial	Public Utility	Public School	High School	College	Hospital	Post Office	Church	Downhill Skiing Employees	Downhill Skiers	Cross-Country Skiers	
1	0	0	0	0	0	0	234	154	0	0	0	0	0	0	0	0	1300	9950	0	
2	66	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	68	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	
5	39	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	30	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7	0	19	0	1	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8	0	16	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	
9	19	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10	17	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	37	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
12	29	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13	25	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14	34	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15	24	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16	24	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17	11	19	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	287	14	0	0	0	0	0	0	0	0	0	0	0	
20	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
21	0	75	0	0	101	23	0	0	0	0	0	0	0	0	0	0	0	0	0	
22	42	5	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
23	0	81	0	0	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24	17	19	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
25	21	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
26	23	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
27	0	98	0	2	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
28	0	0	0	0	0	0	231	0	0	0	0	0	0	0	0	0	400	3700	0	
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
30	0	0	0	0	31	30	0	0	0	0	0	0	0	0	0	0	0	0	0	
31	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	0	0	
32	0	0	0	0	0	60	0	12	0	0	0	0	0	0	0	0	0	0	0	
33	4	20	0	3	36	28	0	0	0	0	0	0	0	0	0	0	0	0	0	
34	3	16	0	3	0	21	0	9	0	0	0	0	0	0	0	0	0	0	0	
35	11	99	0	8	3	106	0	16	0	0	0	0	0	0	0	0	0	0	0	
36	8	0	0	2	0	151	0	0	0	0	0	0	0	0	7400	0	0	0	0	
37	0	0	0	0	14	72	0	36	11	0	0	0	0	0	2	0	0	0	0	
38	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150	
40	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
42	0	0	0	0	0	0	0	110	0	0	0	0	0	0	0	0	400	7400	0	
43	0	24	0	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
44	0	31	0	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
45	7	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
46	15	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
47	30	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
48	47	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
49	33	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
50	0	86	0	0	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
51	0	32	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
53	0	0	0	0	0	57	0	0	0	0	0	0	0	0	0	0	0	0	0	
54	0	0	0	0	0	37	0	0	0	0	0	0	0	0	0	0	0	0	0	
55	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
56	0	11	0	3	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	
57	2	33	0	2	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
58	7	63	0	4	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
59	7	88	0	9	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
60	9	64	0	8	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Existing Land Uses																				
TAZ	1	3	4	5	7	10	11	13	21	23	31	32	33	34	36	37	39	40	41	
	SF Resident	MF Resident	Mobile Home	SF Visitor	MF Visitor	Lodging Hotel	Resort Hotel	Retail/ Commercial	Light Industrial	Public Utility	Public School	High School	College	Hospital	Post Office	Church	Downhill Skiing Employees	Downhill Skiers	Cross-Country Skiers	
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
62	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
65	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
66	17	87	0	0	3	36	0	0	0	0	0	0	0	0	0	0	0	0	0	
67	8	68	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
68	15	40	0	0	4	59	0	4	0	0	0	0	0	0	0	0	0	0	0	
69	8	59	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
70	13	35	0	0	9	0	0	11	0	0	0	0	0	0	0	0	0	0	0	
71	4	69	0	0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
72	16	35	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	
73	5	86	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
74	0	10	0	0	0	14	0	117	0	0	0	0	0	0	0	0	0	0	0	
75	17	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
76	0	182	0	1	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
77	0	119	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
78	0	110	0	0	53	0	0	0	0	0	0	0	0	0	0	3	0	0	0	
79	0	0	0	1	11	0	0	88	0	0	0	0	0	0	0	0	0	0	0	
80	0	97	0	0	40	0	0	27	0	0	0	0	0	0	0	0	0	0	0	
81	0	0	0	0	44	156	0	70	0	0	0	0	0	0	0	0	0	0	0	
82	0	54	0	0	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
83	0	4	0	0	0	71	0	15	0	0	0	0	0	0	0	0	0	0	0	
84	0	0	0	0	64	0	0	102	42	0	0	0	0	0	0	0	0	0	0	
85	0	158	0	0	30	0	0	3	0	0	0	0	0	0	0	0	0	0	0	
86	0	0	0	1	21	0	0	102	25	0	0	0	0	0	0	2	0	0	0	
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	
88	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	
89	0	0	0	0	0	0	0	0	0	0	0	314	0	0	0	0	0	0	0	
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
91	0	0	0	0	0	0	0	0	0	0	264	0	0	0	0	0	0	0	0	
92	0	0	0	0	0	0	0	0	0	0	568	0	0	0	0	0	0	0	0	
93	82	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
94	0	0	0	2	0	0	0	0	227	0	0	0	0	0	0	0	0	0	0	
95	38	73	0	23	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
96	1	85	0	9	48	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
97	22	66	0	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
98	31	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
99	33	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
100	19	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
101	0	18	0	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
102	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
103	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
104	0	33	0	8	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
106	30	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
107	33	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
108	0	19	0	1	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
109	0	21	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
111	3	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
112	2	12	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
113	0	44	38	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
114	0	110	41	0	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
115	0	32	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
116	0	32	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
117	0	57	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
118	0	10	0	0	0	0	0	29	0	0	0	0	0	0	0	0	0	0	0	
119	0	0	0	0	0	0	0	182	0	0	0	0	0	0	0	0	0	0	0	
120	0	45	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Existing Land Uses																				
TAZ	1	3	4	5	7	10	11	13	21	23	31	32	33	34	36	37	39	40	41	
	SF Resident	MF Resident	Mobile Home	SF Visitor	MF Visitor	Lodging Hotel	Resort Hotel	Retail/ Commercial	Light Industrial	Public Utility	Public School	High School	College	Hospital	Post Office	Church	Downhill Skiing Employees	Downhill Skiers	Cross-Country Skiers	
121	0	0	0	0	0	8	24	0	54	0	0	0	0	0	0	0	0	0	0	
122	0	57	0	0	13	0	0	8	0	1	0	0	0	0	0	0	0	0	0	
123	0	0	0	0	0	0	0	4	6	0	0	0	0	0	0	0	0	0	0	
124	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
126	0	0	0	0	0	0	0	0	0	35	0	0	0	0	0	3	0	0	0	
127	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	
128	4	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
129	0	11	0	0	102	0	179	0	0	0	0	0	0	0	0	0	0	0	0	
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	3900	0	
131	0	79	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
132	0	89	0	0	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
133	20	82	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
134	20	56	0	16	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
135	10	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
136	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
137	26	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
138	0	161	0	0	96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
139	0	151	0	0	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
140	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	
141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
143	22	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
144	11	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
145	5	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
146	23	0	0	13	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	
147	18	9	0	11	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
148	34	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
149	0	38	0	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
151	0	24	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0	0	
152	0	0	0	0	41	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
153	0	0	0	0	0	0	45	1	0	0	0	0	0	0	0	0	0	0	200	
154	25	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
155	20	0	0	16	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	
156	37	18	0	10	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	
157	42	53	0	11	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
158	6	19	53	6	0	10	0	0	0	0	0	0	0	0	0	3	0	0	0	
159	0	105	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	
160	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	
161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
164	6	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
165	0	226	0	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Totals	1454	4023	132	627	2426	997	976	1305	311	49	832	314	0	21	7402	14	2163	24950	350	

Appendix B: Future Land Uses



Future Land Uses																				
	1	3	4	5	7	10	11	13	21	23	31	32	33	34	36	37	39	40	41	
	SF Resident	MF Resident	Mobile Home	SF Visitor	MF Visitor	Lodging Hotel	Resort Hotel	Retail/ Commercial	Light Industrial	Public Utility	Public School	High School	College	Hospital	Post Office	Church	Downhill Skiing Employees	Downhill Skiers	Cross-Country Skiers	
1	0	0	0	0	0	0	234	154	0	0	0	0	0	0	0	0	1300	10400	0	0
2	78	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	73	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
5	49	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	36	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	19	0	1	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	16	0	0	0	123	0	7	0	0	0	0	0	0	0	0	0	0	0	0
9	24	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	25	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	39	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	29	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	40	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	40	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	25	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	31	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	12	31	0	1	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	287	65	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	2	2	0	276	22	0	0	0	0	0	0	0	0	0	0	0	0
21	0	75	0	0	101	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	49	5	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	81	0	0	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	18	19	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	27	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	26	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	102	0	2	63	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	231	0	0	0	0	0	0	0	0	0	400	6400	0	0
29	0	0	0	0	22	0	229	12	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	31	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	198	22	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	54	60	300	30	0	0	0	0	0	0	0	0	0	0	0	0
33	4	21	0	3	38	68	0	12	0	0	0	0	0	0	0	0	0	0	0	0
34	3	22	0	3	0	226	0	82	0	0	0	0	0	0	0	0	0	0	0	0
35	13	104	0	8	3	121	0	45	0	0	0	0	0	0	0	0	0	0	0	0
36	8	8	0	2	0	152	0	63	0	0	0	0	0	0	7400	0	0	0	0	0
37	0	0	0	0	14	99	0	64	0	0	0	0	0	0	0	0	0	0	0	0
38	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150	0
40	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	110	0	0	0	0	0	0	0	0	400	6200	0	0
43	0	39	0	0	59	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	31	0	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	9	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	17	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	36	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	49	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	36	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	86	0	0	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	32	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	364	19	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	57	180	30	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	59	0	14	0	0	0	0	0	0	0	0	0	0	0	0
55	0	50	0	0	50	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	15	0	3	0	82	0	21	0	0	0	0	0	0	0	0	0	0	0	0
57	3	38	0	3	32	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	8	63	0	4	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	10	92	0	10	21	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	11	64	0	10	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Future Land Uses																				
	1	3	4	5	7	10	11	13	21	23	31	32	33	34	36	37	39	40	41	
	SF Resident	MF Resident	Mobile Home	SF Visitor	MF Visitor	Lodging Hotel	Resort Hotel	Retail/ Commercial	Light Industrial	Public Utility	Public School	High School	College	Hospital	Post Office	Church	Downhill Skiing Employees	Downhill Skiers	Cross-Country Skiers	
61	0	0	0	0	188	188	0	0	0	0	0	0	0	0	0	0	0	0	0	
62	0	0	0	0	18	51	0	0	0	0	0	0	0	0	0	0	0	0	0	
63	25	30	0	25	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
64	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
65	0	9	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
66	17	89	0	0	3	45	0	10	0	0	0	0	0	0	0	0	0	0	0	
67	8	81	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
68	15	61	0	0	6	75	0	14	0	0	0	0	0	0	0	0	0	0	0	
69	8	68	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
70	13	41	0	0	11	19	0	18	0	0	0	0	0	0	0	0	0	0	0	
71	4	75	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
72	16	46	0	0	0	2	0	6	0	0	0	0	0	0	0	0	0	0	0	
73	5	99	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
74	0	10	0	0	0	38	0	97	0	0	0	0	0	0	0	0	0	0	0	
75	19	161	0	2	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
76	0	186	0	1	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
77	0	119	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
78	0	110	0	0	53	0	0	0	0	0	0	0	0	0	0	3	0	0	0	
79	0	0	0	1	11	29	0	82	0	0	0	0	0	0	0	0	0	0	0	
80	0	108	0	0	45	23	0	21	0	0	0	0	0	0	0	0	0	0	0	
81	0	0	0	0	44	487	0	40	0	0	0	0	0	0	0	0	0	0	0	
82	0	54	0	0	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
83	0	4	0	0	0	99	0	45	0	0	0	0	0	0	0	0	0	0	0	
84	0	0	0	0	64	24	0	47	0	0	0	0	0	0	0	0	0	0	0	
85	0	173	0	0	33	26	0	0	0	0	0	0	0	0	0	0	0	0	0	
86	0	0	0	1	21	30	0	102	0	0	0	0	0	0	0	2	0	0	0	
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	
88	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	
89	0	0	0	0	0	0	0	0	0	0	0	314	0	0	0	0	0	0	0	
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
91	0	0	0	0	0	0	0	0	0	0	264	0	0	0	0	0	0	0	0	
92	0	0	0	0	0	0	0	0	0	0	568	0	0	0	0	0	0	0	0	
93	91	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
94	0	0	0	2	0	0	0	0	422	0	0	0	0	0	0	0	0	0	0	
95	56	103	0	27	24	12	0	0	0	0	0	0	0	0	0	0	0	0	0	
96	1	104	0	9	59	10	0	0	0	0	0	0	0	0	0	0	0	0	0	
97	24	66	0	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
98	33	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
99	38	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
100	22	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
101	24	55	0	14	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
102	0	20	0	0	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
103	0	20	0	0	43	0	500	80	0	0	0	0	0	0	0	0	0	0	0	
104	0	58	0	8	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
106	33	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
107	36	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
108	19	39	0	29	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
109	0	47	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
111	29	0	0	11	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	
112	36	12	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
113	0	44	38	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
114	0	110	41	0	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
115	0	32	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
116	0	32	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
117	0	57	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
118	0	30	0	0	0	30	0	55	0	0	0	0	0	0	0	0	0	0	0	
119	0	0	0	0	0	33	0	112	0	0	0	0	0	0	0	0	0	0	0	
120	0	45	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Future Land Uses																			
	1	3	4	5	7	10	11	13	21	23	31	32	33	34	36	37	39	40	41
	SF Resident	MF Resident	Mobile Home	SF Visitor	MF Visitor	Lodging Hotel	Resort Hotel	Retail/ Commercial	Light Industrial	Public Utility	Public School	High School	College	Hospital	Post Office	Church	Downhill Skiing Employees	Downhill Skiers	Cross-Country Skiers
121	0	0	0	0	8	42	0	59	0	0	0	0	0	0	0	0	0	0	0
122	0	69	0	0	16	24	0	46	0	1	0	0	0	0	0	0	0	0	0
123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
124	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
126	0	0	0	0	0	0	0	0	0	35	0	0	0	0	0	3	0	0	0
127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
128	44	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
129	0	11	0	0	102	0	179	0	0	0	0	0	0	0	0	0	0	0	0
130	0	0	0	0	0	0	106	80	0	0	0	0	0	0	0	0	63	5350	0
131	0	79	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
132	0	89	0	0	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0
133	32	82	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
134	20	56	0	16	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135	19	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
136	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	41	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
138	0	185	0	0	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0
139	0	211	0	0	180	37	0	0	0	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0
141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143	23	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
144	11	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
145	7	1	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	30	29	0	13	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
147	20	13	0	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
148	37	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
149	0	61	0	0	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
151	0	24	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0	0
152	0	87	0	0	94	0	0	0	0	1	0	0	0	0	0	0	0	0	0
153	0	0	0	0	0	0	45	1	0	0	0	0	0	0	0	0	0	0	200
154	75	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	26	3	0	17	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
156	52	25	0	11	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0
157	48	65	0	11	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0
158	9	28	53	6	0	13	0	0	0	0	0	0	0	0	0	3	0	0	0
159	0	144	0	0	1	0	0	5	0	0	0	0	0	0	0	0	0	0	0
160	0	197	0	0	198	0	200	4	0	0	0	0	0	0	0	0	0	0	0
161	0	197	0	0	198	0	200	61	0	0	0	0	0	0	0	0	0	0	0
162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
164	12	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
165	0	256	0	0	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0
166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1925	5416	132	700	3563	2574	3529	1828	422	49	832	314	0	33	7400	14	2163	28350	350
Existing	1454	4023	132	627	2426	997	976	1305	311	49	832	314	0	21	7402	14	2163	24950	350
Total - Existing	471	1393	0	73	1137	1577	2553	523	111	0	0	0	0	12	-2	0	0	3400	0
% Increase	32%	35%	0%	12%	47%	158%	262%	40%	36%	-1%	0%	0%	0%	57%	0%	0%	0%	14%	0%

Appendix C: Mammoth Lakes Travel Demand Model User's Guide



Mammoth Lakes Travel Demand Model

User Guide

1. Model Inputs

The model relies on the following input files:

Roadway Network.dbd

This is the geographic roadway network file containing all roadway links and nodes. It is based on a GIS file with some additional fields that are required by TransCAD. These include:

AB_Lanes/BA_Lanes	number of lanes in each direction
Capacity_HR	hourly total capacity of roadway used in the peak hour model
Capacity_ADT	daily total capacity used in the daily model
85th_Speed	85th percentile speed used to determine vehicle travel time
AB_VehicleTT/BA_VehicleTT	vehicle travel times in each direction, determined by dividing length by 85th percentile speed
BusTT	transit travel time, determined by dividing length by bus speed (assumed to be 12 mph)
WalkTT	walk travel time, determined by dividing length by 4 feet/second
LinkType	functional classification of roadway <ul style="list-style-type: none">• 0 - Centroid Connector• 1 - State Route• 2 - Arterial• 3 - Collector• 4 - Local• 5 - County Road• 6 - Other• 7 - Private• 8 - Alley• 9 - USFS Route

The roadway network file also contains count data for existing counts in the 2009_ADT and 2009_PeakHour fields. These fields were used in the calibration process.

Traffic Analysis Zones.dbd

This is the geographic representation of the Traffic Analysis Zones (TAZ) used by the model. The model uses the size of each TAZ to determine intrazonal travel times.

Transit System.rts

The transit system information, including routes and stops, are stored in this file. The routes are displayed on the underlying roadway network. Transit specific information is stored inside fields in this file. These include:

Headway	headways between buses
Transfer_Penalty	the transfer penalty for each route, typically half of the headway

The total base ridership for each route is also stored in this file to assist during the calibration step.

land_use_data.dbf

This is the data file that contains the land use quantities by TAZ. The first row contains the TAZ numbers while the remaining rows contain the quantities by each land use type. Any land use changes need to be reflected in this file.

trip_rates.dbf

The trip rates used by the model for each land use type are stored in this file. Both attraction and production rates for each of the five trip purposes are listed (home based recreation, home based shopping, home based work, home based other, and other to other).

Base_VehicleTT.bin

This are the base vehicle travel times for each roadway link calculated by dividing link length by 85th percentile speeds. These values are used to reset model adjustments and ensure that the each model runs begins with a set of base vehicle travel times. Various travel time penalties are then added throughout the model steps.

ski_area_penalty.bin

This file contains the vehicle travel time penalties for the ski areas. These values are added to the base vehicle travel times to artificially inflate them and therefore increase the transit share. The values were calculated to obtain a transit share for each ski area that matched the transit share from the Town's travel survey.

external_gates.bin

The attractions and productions for the three external gates are included in this file. These values are based on actual traffic counts at the external gates and need to be adjusted for

future scenarios. They are incorporated with the TAZ attractions and productions in the trip distribution step.

adjusted_friction_factors.bin

These are the friction factors that are used by the model in the gravity model to determine trip distribution. Factors for each of the five trip types are provided. These are based on the factors used in the prior model with some adjustments to provide better trip distribution results.

K-Factors.mtx

This matrix stores the K-factors that are used in the gravity model. Most TAZ pairs have a K-factor of 1.00 meaning that no adjustment is made. However, the K-factor was adjusted for some pairs in order to make trips between these zone more/less attractive. Specifically, this was used to adjust ski area distribution and the distribution in the Mammoth Slopes neighborhood to get the desired results.

ADT TT adjustments.bin

Adjustments to vehicle travel time in order to calibrate the daily model are stored in this file. These travel time are added to the base vehicle travel times to modify the demand on particular roadway links.

PH TT adjustments.bin

Adjustments to vehicle travel time in order to calibrate the peak hour model are stored in this file. These travel time are added to the base vehicle travel times to modify the demand on particular roadway links.

turning_movement_table.bin

Intersection data used in the peak hour assignment is stored in this file. This information is used to determine delays at signalized intersections during the assignment process.

2. Running the Model

To run the model, the resource file that contains all the instructions needs to be compiled within TransCAD. To do this, go to "Tools" and "GIS Developer's Kit" to open the GISDK Toolbox. In the toolbox, the third icon allows you to "Compile to UI". Select this option to compile the resource file to a UI file. Navigate to the correct resource file and open it. TransCAD will then ask for the location of the UI file. Navigate to the model folder and save it there.

To add the UI file to the Tools menu, go to "Tools" and "Setup Add-ins..." A dialog box will open allowing you to add the model to the Tools menu. Select "Add" and complete the required fields:

Type	type of menu, select "Dialog Box"
Description	a short name for the model to be listed in the Tools menu (ie. base model or future model)
Name	name of the model from the resource file, this must be list as "Mammoth Lakes Model"
UI Database	location of the compiled UI file, navigate to the UI file that was compiled earlier
In Folder	the folder you wish to place the model into within the Tools menu, generally left as "None"

Once the model has been set up, close the dialog box by clicking "OK". The model should now be listed under the Tools menu under "Add-Ins". Navigate to it and select the correct model to run the model dialog box. This will open the model dialog box which is used to run the model steps.

A total of seven individual model steps are listed. These include:

- Trip Generation
- Trip Distribution
- Mode Split
- Preliminary Assignment
- Feedback Loop
- Final Daily Assignment
- Peak Hour Assignment

To run the model, click on each model step in succession and wait a few seconds for the operations to complete. The correct order is as follows:

- Trip Generation
- Trip Distribution

- Model Split
- Preliminary Assignment
- Feedback Loop
- Preliminary Assignment
- Feedback Loop
- Final Daily Assignment

The feedback loop and preliminary assignment are each run twice before the final assignment. These steps calculate congested travel times and feed them back into the gravity model. This ensures that the gravity model accounts for congestion. Based on convergence tests, it takes two iterations for the gravity model to converge. This is why the preliminary assignment and feedback loop need to be run twice. Please also note that at the end of each feedback loop step, all open windows must be closed before the model can continue. This is due to the fact that the preliminary assignment cannot be completed unless all windows are closed. The model will provide a prompt to remind the user of this step. Once the gravity model converges, the final daily assignment and peak hour assignments can be executed.

The Peak Hour Assignment step should be run independently after the daily model is executed. This is necessary due to the fact that both the peak hour and daily model assignments utilize some of the same files and require that these files be closed prior to the execution of each step. Close the model menu and all open windows, re-enter the model menu and run the Peak Hour Assignment step. Due to limitations of the TransCAD GISDK scripting language, the final step of the peak hour assignment cannot be scripted and has to be performed manually. In order to do this, close all open windows and open the following files:

- Roadway Network.dbd
- turning_movement_table.bin
- PH Vehicle PA to OD.mtx

Make sure that the Roadway Network.dbd file is selected and go to "Planning", "Single-Class Traffic Assignment", and "Volume Dependant Turning Delays". A dialog box will open requesting that you select the appropriate network file. Select "Network.net" in the model folder. The next box requires the correct network settings. Select "Centroids are in network" or "Create from Selection set", Link Type to "In Use", and Penalties to "None". The next dialog box will ask for the assignment method that you want to use. Select the following options:

Method	Stochastic User Equilibrium
Matrix File	PA to OD
Matrix	QuickSum
Movement Table	turning_movement_table
Signal Plans	navigate to the Signal Plans.tms file in the model folder
Time	AB_VehicleTT/BA_VehicleTT

Capacity	Capacity_HR
Number of Lanes	AB_Lanes/BA_Lanes
Alpha	None
Beta	None
Control Type	AB_Control/BA_Control
Iterations	20
Relative Gap	0.01
Alpha	0.15
Beta	4.00

Once you've selected the correct options, select "OK". TransCAD will then ask for the location of the output files. Navigate to the model folder and select "OK". The peak hour assignment will then be performed and a dialog box will open indicating whether the procedure was a success or if there were problems.

3. Model Outputs

Once the model has been run, the following output files will be created:

ASN_LinkFlow.bin

This file contains the results of the daily assignment model. Various parameters are provided by direction. The traffic volumes are stored in rows two through four (AB_Flow, BA_Flow, and Tot_Flow.) The .bin file can be joined to the Roadway Network.dbd file to graphically display the results. Please review the TransCAD manual on how to join .bin files to geographic files.

LinkFlow.bin

This file contains the results of the peak hour assignment model. Various parameters are provided by direction. The traffic volumes are stored in rows two through four (AB_Flow, BA_Flow, and TOT_Flow.) The .bin file can be joined to the Roadway Network.dbd file to graphically display the results. Please review the TransCAD manual on how to join .bin files to geographic files.

TASN_ONO.bin

The daily transit on and off results by route are stored in this file. The results can be grouped by "ROUTE" to get the total ridership by each route. Go to "Dataview" and "Group By ..." to group the results.

PH_TASN_ONO.bin

The peak hour transit on and off results by route are stored in this file. The results can be grouped by "ROUTE" to get the total ridership by each route. Go to "Dataview" and "Group By ..." to group the results.

4. Modifying Model Inputs

The model can be modified in various ways, including changing the land use, changing the external gate productions and attractions, modifying the roadway network, and adjusting the transit share.

Land Use

To change the land use, open the land_use_data.dbf file and adjust the quantities. The model will then need to be re-run and will reflect the new land use values.

External Gate Productions and Attractions

To modify the amount of productions and attractions that are generated by the external gates, open the external_gates.bin file and edit the values at the bottom of the table. The three external gates are 701, 702, and 703, so only values for these three zones should be adjusted.

Roadway Network

To adjust roadway laneage and capacities, open the Roadway Network.dbd file and adjust these values in the AB_Lanes/BA_Lanes and Capacity_HR/Capacity_ADT fields for the specific roadway links.

To add new roadway connections, open the Roadway Network.dbd file and go to "Tools", "Map Editing", and "Toolbox". A toolbox to allow you to edit the roadway map will appear. You can then perform the editing functions, such as adding new roadway connections. For detail on how to perform edits on line features, please see Chapter 24 of the TransCAD User's Guide. Make sure that your connections are not between centroid connector nodes, by turning on the node layer (under "Map" and "Layers") and not utilizing nodes 1 through 167 as well as 701, 702, and 703.

Once the new roadway links have been created, please note the ID of each link as this information will be used to edit various other input files. The appropriate values for each of the required roadway network fields listed in the Model Inputs section will need to be filled out for the new roadway links. All other fields can remain blank.

Since various other inputs are associated with the roadway network file, they will need to be modified to add the new links that have been created.

Base_VehicleTT.bin

The base AB_VehicleTT/BA_VehicleTT values for all new links should be entered into this file. This will require that new fields be created and the correct ID and travel times entered for each new link.

ski_area_penalty.bin	This file will need to be modified to include the new roadway links. New fields for each new link should be created and the correct ID entered. The additional travel time penalty should be 0.00 for each direction.
ADT_TT_Adjustments.bin	This file will need to be modified to include the new roadway links. New fields for each new link should be created and the correct ID entered. The additional travel time adjustment should be 0.00 for each direction unless manual adjustments to the travel time are desired.
PH_TT_Adjustments.bin	This file will need to be modified to include the new roadway links. New fields for each new link should be created and the correct ID entered. The additional travel time adjustment should be 0.00 for each direction unless manual adjustments to the travel time are desired.

Once all the required changes are made, the model can be re-run and will reflect the addition of the new roadway links.

Transit Share

The easiest method to modify the transit share is to adjust the transit travel time to vehicle travel time ratio. Since the transit share is inversely proportional to the ratio, increasing the ratio will lower the transit share while reducing the ratio will increase the transit share. There are two ways to adjust the travel time ratio, either increasing the vehicle travel time or decreasing the transit travel time.

To increase vehicle travel time, higher base vehicle travel times can be computed by assuming lower roadway speeds. For example, they can be computed by dividing the length by 70 percent of the speed, therefore assuming that vehicle speeds are 30 percent lower than in the current model. The Roadway Network.dbd and Base_VehicleTT.bin files will need to be modified to include these higher vehicle travel times.

To modify transit travel times, the BusTT field in the Roadway Network.dbd file will need to be adjusted. The base model assumes a transit speed of 12 mph. Lower transit travel times can be used by assuming a higher speed and re-calculating the travel times.

Either of these two modifications will impact the transit travel time to vehicle travel time ratio and increase the transit share for each TAZ. The model will then need to be re-run to see the effects of this change. To compute the overall transit share, a comparison of total transit trips to total trips will need to be made. The total trips found in the Transit PA to OD.mtx file should be divided by the total trips in the Trip Distribution.mtx file (to get the total trips, create a

QuickSum matrix and go to "Matrix" and "Statistics" to get the sum of the QuickSum matrix). To get specific transit share percentages, a trial and error approach may need to be used to determine the exact changes to the vehicle or transit travel times that will be needed.

5. Moving the Model

It is recommended that the whole model directory be copied for all additional model runs. In addition to copying the folder, several additional steps will need to be performed. TransCAD stores the path to the model files inside the resource file. As a result, the resource file will need to be edited to change all reference to the path to the new location. This can be done fairly easily within Notepad. Open the "mammoth_lakes_model_v1.12.rsc" file and do a replace find within the file. Please note that paths in TransCAD include a double slash instead of a single slash. For example:

```
C:\Program Files\TransCAD\ = C:\\Program Files\\TransCAD\\
```

Once the resource file has been updated with the new path information, it will need to be re-compiled and a new model menu added under "Tools" and "Setup Add-ins...". To assist in keeping the different model runs organized, it is recommended that a new folder be created under the "Add-ins" menu to keep all the alternative model scenarios in one location.

The other modification that has to be made is to the transit system file. This file stores the location of the underlying roadway network. Since the roadway network file has been moved, the transit route file has to be modified to point the file to the new location. To perform this, open the Roadway Network.dbd file in the new location and select "Route Systems", "Utilities", and "Move...". This opens the move dialog box. Select the Transit System.rts file in the new location and hit "OK" in the following dialog box to accept the default options. The Transit System.rts file will now utilize the correct underlying roadway network file.

Appendix D: Land Use Assumptions



Traffic Model Alternatives 4 and 5

Buildout DNDP Land use with Complete Circulation Network

Purpose:

To test the traffic impacts on the “complete circulation network” related to potential increases to land use (residential and commercial) within the DNDP Study Area associated with increased available land due to ROW relinquishment, redevelopment of the existing USFS compound/campground, and redevelopment of the existing RV Park . Potential ROW relinquishment would produce approximately 175,000 (4 acres) additional buildable square feet on Main Street between Manzanita Road and Sierra Park Road.

Methodology:

Buildout “DNDP” Land use with Complete Circulation Network = Buildout “Baseline” Land use + DNDP Land use

Where:

- Complete Circulation Network = existing roadway network plus future roads as recommended in the DNDP/Mobility Plan
- Buildout “Baseline” Land use = PAOT assumptions for Residential; Commercial = approved projects + 0.25 FAR for vacant/redevelopment CG/CL land
- DNDP Land use = potential additional rooms/units and commercial square footage due to ROW relinquishment, redevelopment of USFS/RV Park areas

ROW Relinquishment Assumptions:

- 2,850 lineal feet on South side of Main Street between Manzanita and Sierra Park Road
- 1,500 lineal feet on North side of Main Street between Manzanita and Forest Trail
- 40 feet additional ROW on south and north side of Main Street
- Additional rooms at 80 RPA = 320
- Additional commercial square footage depends on assumed FAR. Minimum 0.25 FAR = 30,000 sq. ft. of additional commercial

USFS Compound and Campground Assumptions:

- Location of future Civic Center, additional employee housing, and retail
 - Retail 30,000 sq. ft.
 - 18 existing USFS units. Increase to 100
 - Civic Center – insignificant impact on traffic model because of winter Saturday design day

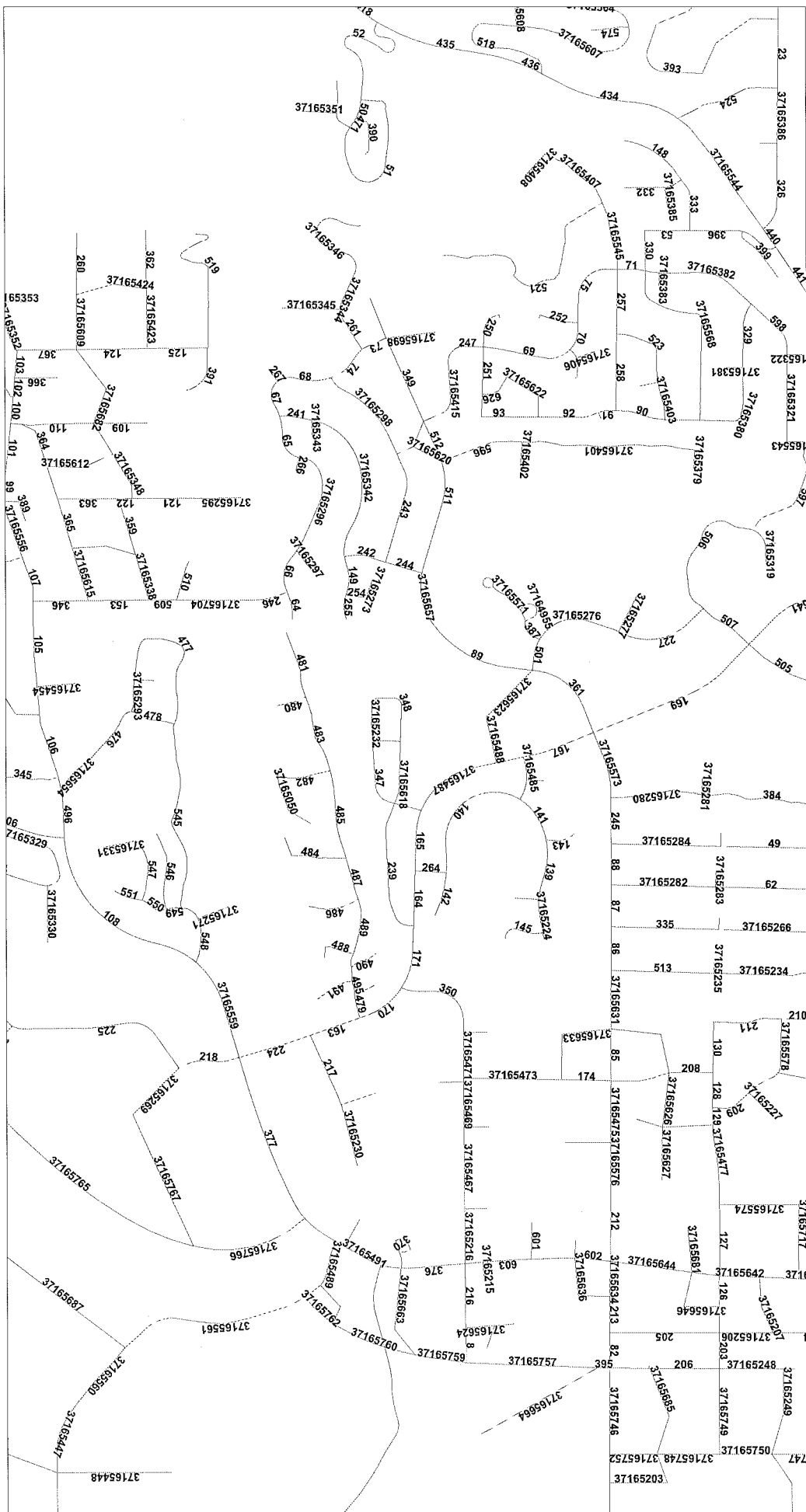
RV Park Assumptions:

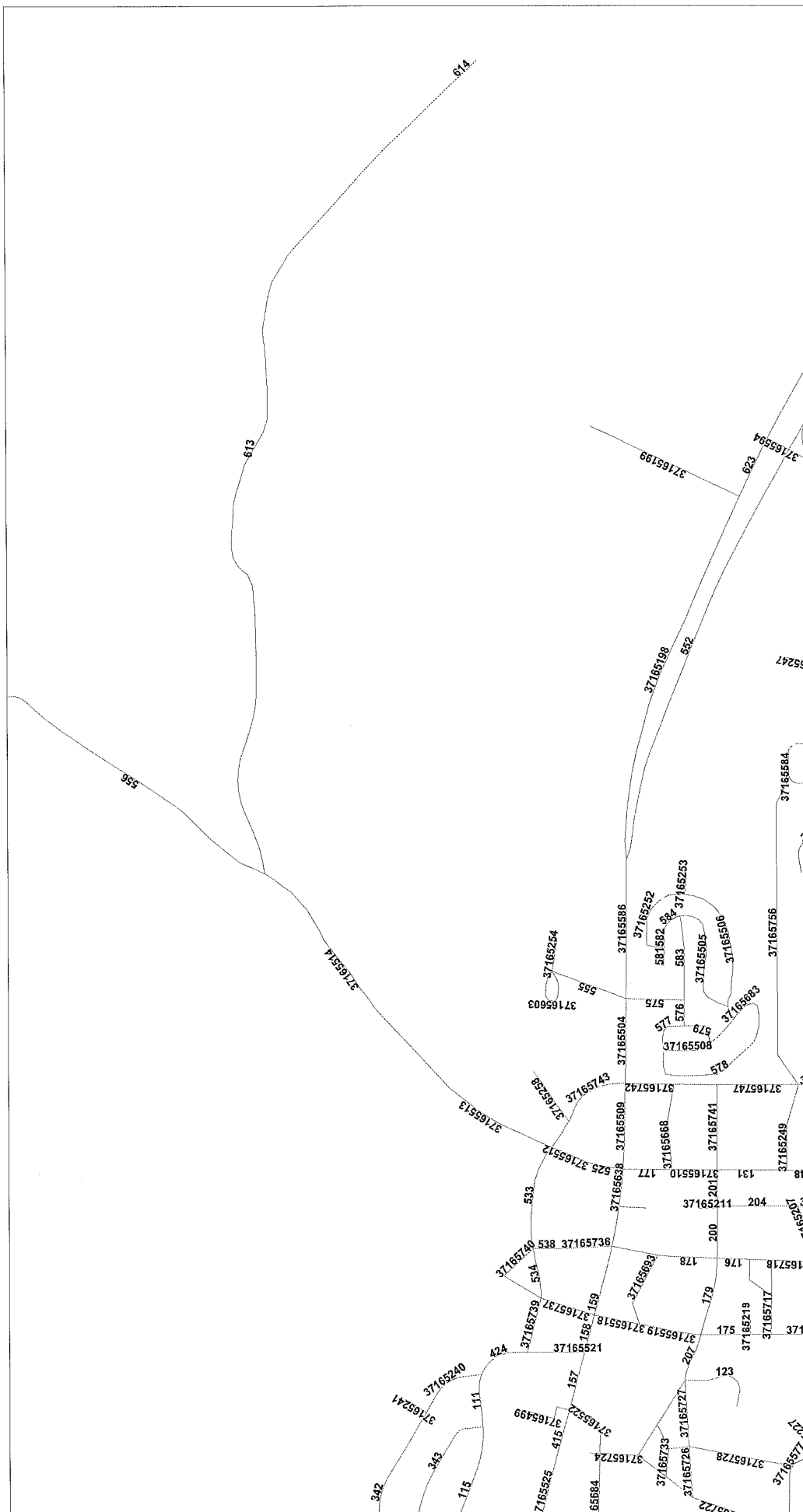
- Location of future Sports/Events park
 - Sports/Event Park – insignificant impact on traffic model because of winter Saturday design day

TAZ	Existing Land Use	Buildout Baseline Land Use	Buildout DNDP Land Use (Alts 4/5)
36	<ul style="list-style-type: none"> SF = 10 MF = 0 Lodging = 151 Post Office = 7400 	<ul style="list-style-type: none"> SF = 10 MF = 8 Lodging = 152 Post Office = 7400 Retail = 75,000 	<ul style="list-style-type: none"> SF = 10 MF = 8 Lodging = 211 Post Office = 7400 Retail = 83,000
37	<ul style="list-style-type: none"> MF = 14 Lodging = 72 Retail = 36,000 	<ul style="list-style-type: none"> MF = 14 Lodging = 99 Retail = 77,000 	<ul style="list-style-type: none"> MF = 14 Lodging = 150 Retail = 84,000
38	<ul style="list-style-type: none"> SF = 18 	<ul style="list-style-type: none"> SF = 18 	<ul style="list-style-type: none"> SF = 18 MF = 32 Retail = 15,000 Civic Center (Retail as proxy) = 2000
39	<ul style="list-style-type: none"> XC Skiers = 150 	<ul style="list-style-type: none"> XC Skiers = 150 	<ul style="list-style-type: none"> XC Skiers = 150 MF = 50 Retail = 15,000
74	<ul style="list-style-type: none"> MF = 10 Lodging = 14 Retail = 117,000 	<ul style="list-style-type: none"> MF = 10 Lodging = 38 Retail = 117,000 	<ul style="list-style-type: none"> MF = 10 Lodging = 148 Retail = 132,000
79	<ul style="list-style-type: none"> SF = 1 MF = 11 Lodging = 0 Retail = 88,000 	<ul style="list-style-type: none"> SF = 1 MF = 11 Lodging = 29 Retail = 99,000 	<ul style="list-style-type: none"> SF = 1 MF = 11 Lodging = 88 Retail = 107,000
83	<ul style="list-style-type: none"> MF = 4 Lodging = 71 Retail = 15,000 	<ul style="list-style-type: none"> MF = 4 Lodging = 99 Retail = 54,000 	<ul style="list-style-type: none"> MF = 4 Lodging = 139 Retail = 59,000
87	<ul style="list-style-type: none"> Church = 3,000 	<ul style="list-style-type: none"> Church = 3,000 	<ul style="list-style-type: none"> Church = 3,000 Sports/Events Park (Retail as proxy) = 2000
90	<ul style="list-style-type: none"> RV Park 	<ul style="list-style-type: none"> RV Park 	<ul style="list-style-type: none"> Sports/Events Park (Retail as proxy) = 2000
Total	<ul style="list-style-type: none"> SF = 29 MF = 39 Lodging = 308 Retail = 256,000 Post Office = 7,400 Church = 3,000 XC Skiers = 150 	<ul style="list-style-type: none"> SF = 29 MF = 47 Lodging = 417 Retail = 422,000 Post Office = 7,400 Church = 3,000 XC Skiers = 150 	<ul style="list-style-type: none"> SF = 29 MF = 129 Lodging = 736 Retail = 495,000 Post Office = 7,400 Church = 3,000 XC Skiers = 150 Sports/Event (Retail proxy) = 4,000 s.f. Civic Center Offices (Retail proxy) = 2,000 s.f.

Traffic Model - Land Use Change Summary Table

TAZ	Existing Land Use	Buildout Baseline Land Use	Buildout DNDP Land Use (Alts 4/5)	Change in Land Use Between Buildout "Baseline" and DNDP (Alts 4/5)
36	<ul style="list-style-type: none"> ○ SF/MF = 10 ○ Lodging = 151 	<ul style="list-style-type: none"> ○ SF/MF = 18 ○ Lodging = 152 ○ Retail = 75,000 	<ul style="list-style-type: none"> ○ SF/MF = 18 ○ Lodging = 211 ○ Retail = 83,000 	<ul style="list-style-type: none"> ○ SF/MF = 0 ○ Lodging = 59 ○ Retail = 8,000
37	<ul style="list-style-type: none"> ○ SF/MF = 14 ○ Lodging = 72 ○ Retail = 36,000 	<ul style="list-style-type: none"> ○ SF/MF = 14 ○ Lodging = 99 ○ Retail = 77,000 	<ul style="list-style-type: none"> ○ SF/MF = 14 ○ Lodging = 150 ○ Retail = 84,000 	<ul style="list-style-type: none"> ○ SF/MF = 0 ○ Lodging = 51 ○ Retail = 7,000
38	<ul style="list-style-type: none"> ○ SF/MF = 18 <p>(USFS Compound)</p>	<ul style="list-style-type: none"> ○ SF/MF = 18 	<ul style="list-style-type: none"> ○ SF/MF = 50 ○ Civic Center(retail proxy) = 2,000 ○ Retail = 15,000 	<ul style="list-style-type: none"> ○ SF/MF = 32 ○ Civic Center(retail proxy) = 2,000 ○ Retail = 15,000
39	<p>(USFS Campground)</p>		<ul style="list-style-type: none"> ○ SF/MF = 50 ○ Retail = 15,000 	<ul style="list-style-type: none"> ○ SF/MF = 50 ○ Retail = 15,000
74	<ul style="list-style-type: none"> ○ SF/MF = 10 ○ Lodging = 14 ○ Retail = 117,000 	<ul style="list-style-type: none"> ○ SF/MF = 10 ○ Lodging = 38 ○ Retail = 117,000 	<ul style="list-style-type: none"> ○ SF/MF = 10 ○ Lodging = 148 ○ Retail = 132,000 	<ul style="list-style-type: none"> ○ SF/MF = 0 ○ Lodging = 110 ○ Retail = 15,000
79	<ul style="list-style-type: none"> ○ SF/MF = 12 ○ Retail = 88,000 	<ul style="list-style-type: none"> ○ SF/MF = 12 ○ Lodging = 29 ○ Retail = 99,000 	<ul style="list-style-type: none"> ○ SF/MF = 12 ○ Lodging = 88 ○ Retail = 107,000 	<ul style="list-style-type: none"> ○ SF/MF = 0 ○ Lodging = 59 ○ Retail = 8,000
83	<ul style="list-style-type: none"> ○ SF/MF = 4 ○ Lodging = 71 ○ Retail = 15,000 	<ul style="list-style-type: none"> ○ SF/MF = 4 ○ Lodging = 99 ○ Retail = 54,000 	<ul style="list-style-type: none"> ○ SF/MF = 4 ○ Lodging = 139 ○ Retail = 59,000 	<ul style="list-style-type: none"> ○ SF/MF = 0 ○ Lodging = 40 ○ Retail = 5,000
87	<p>(Existing Civic Center Site)</p>		<ul style="list-style-type: none"> ○ Sports/Event (Retail proxy) = 2,000 	<ul style="list-style-type: none"> ○ Sports/Event (Retail proxy) = 2,000
90	<p>(RV Park)</p>		<ul style="list-style-type: none"> ○ Sports/Event (Retail proxy) = 2,000 	<ul style="list-style-type: none"> ○ Sports/Event (Retail proxy) = 2,000
Total	<ul style="list-style-type: none"> ○ SF/MF = 68 ○ Lodging = 308 ○ Retail = 256,000 	<ul style="list-style-type: none"> ○ SF/MF = 76 ○ Lodging = 417 ○ Retail = 422,000 	<ul style="list-style-type: none"> ○ SF /MF= 158 ○ Lodging = 736 ○ Retail = 495,000 	<ul style="list-style-type: none"> ○ SF /MF= 82 units (82 new USFS units) ○ Lodging = 319 rooms ○ Retail = 73,000 s.f. (includes 30,000 s.f. on USFS) ○ Sports/Event (Retail proxy) = 4,000 s.f. ○ Civic Center Offices (Retail proxy) = 2,000 s.f.

















Travel Model Level of Service Reports

Base (Existing Conditions) LOS Reports

HCM Unsignalized Intersection Capacity Analysis
1: Forest Trail & Minaret Road

Saturday Peak - Base
9/23/2010














												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↔			↔			↔		
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	20	25	90	15	15	10	70	165	25	65	635	100
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	28	100	17	17	11	78	183	28	72	706	111
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1278	1272	761	1372	1314	197	817	211				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1278	1272	761	1372	1314	197	817	211				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	81	81	75	76	88	99	90	95				
cM capacity (veh/h)	114	143	405	71	135	844	811	1359				
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	150	44	289	889								
Volume Left	22	17	78	72								
Volume Right	100	11	28	111								
cSH	236	119	811	1359								
Volume to Capacity	0.64	0.37	0.10	0.05								
Queue Length 95th (ft)	96	38	8	4								
Control Delay (s)	43.5	52.1	3.5	1.4								
Lane LOS	E	F	A	A								
Approach Delay (s)	43.5	52.1	3.5	1.4								
Approach LOS	E	F										
Intersection Summary												
Average Delay				8.1								
Intersection Capacity Utilization				61.2%	ICU Level of Service			B				
Analysis Period (min)				15								

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
Page 1

HCM Unsignalized Intersection Capacity Analysis
2: Lake Mary Road & Davidson

Saturday Peak - Base
9/23/2010













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Free											
Grade	0%											
Volume (veh/h)	0	95	15	70	95	30	10	0	55	45	0	5
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	106	17	78	106	33	11	0	61	50	0	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)	2											
Median type	None											
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	139				122				397	408	114	422
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	139				122				397	408	114	422
tC, single (s)	4.1				4.1				7.1	6.5	6.2	7.1
tC, 2 stage (s)												
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5
p0 queue free %	100				95				98	100	93	90
cM capacity (veh/h)	1445				1465				537	504	939	486
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	122	217	72	56								
Volume Left	0	78	11	50								
Volume Right	17	33	61	6								
cSH	1445	1465	1109	510								
Volume to Capacity	0.00	0.05	0.07	0.11								
Queue Length 95th (ft)	0	4	5	9								
Control Delay (s)	0.0	3.0	9.5	12.9								
Lane LOS		A	A	B								
Approach Delay (s)	0.0	3.0	9.5	12.9								
Approach LOS		A	B									
Intersection Summary												
Average Delay				4.4								
Intersection Capacity Utilization	33.5%			ICU Level of Service					A			
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
Page 2

HCM Signalized Intersection Capacity Analysis
3: Lake Mary Road & Canyon Boulevard

Saturday Peak - Base
9/23/2010

























						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	1.00	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1770	1863	1863	1583	3434	
Flt Permitted	0.63	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1171	1863	1863	1583	3434	
Volume (vph)	15	160	185	205	435	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	17	178	206	228	483	11
RTOR Reduction (vph)	0	0	0	94	5	0
Lane Group Flow (vph)	17	178	206	134	489	0
Turn Type	Perm			Perm		
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	25.9	25.9	25.9	25.9	10.4	
Effective Green, g (s)	26.5	26.5	26.5	26.5	10.5	
Actuated g/C Ratio	0.59	0.59	0.59	0.59	0.23	
Clearance Time (s)	4.6	4.6	4.6	4.6	4.1	
Vehicle Extension (s)	6.1	6.1	6.1	6.1	2.0	
Lane Grp Cap (vph)	690	1097	1097	932	801	
v/s Ratio Prot		0.10	c0.11		c0.14	
v/s Ratio Perm	0.01			0.08		
v/c Ratio	0.02	0.16	0.19	0.14	0.61	
Uniform Delay, d1	3.9	4.2	4.3	4.2	15.4	
Progression Factor	1.00	1.00	0.38	0.93	1.00	
Incremental Delay, d2	0.1	0.3	0.3	0.3	1.0	
Delay (s)	3.9	4.5	2.0	4.2	16.4	
Level of Service	A	A	A	A	B	
Approach Delay (s)		4.5	3.1		16.4	
Approach LOS		A	A		B	
Intersection Summary						
HCM Average Control Delay		9.2		HCM Level of Service	A	
HCM Volume to Capacity ratio		0.31				
Actuated Cycle Length (s)		45.0		Sum of lost time (s)	8.0	
Intersection Capacity Utilization		31.9%		ICU Level of Service	A	
Analysis Period (min)		15				
c Critical Lane Group						

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
Page 3

HCM Signalized Intersection Capacity Analysis
4: Lake Mary Road & Minaret Road

Saturday Peak - Base
9/23/2010

























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.97	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	3433	1674	1674
Flt Permitted	0.47	1.00	1.00	0.36	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	867	3539	1583	673	3539	1583	1770	1863	1583	3433	1674	1674
Volume (vph)	85	385	125	70	295	125	305	240	85	475	50	105
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	94	428	139	78	328	139	339	267	94	528	56	117
RTOR Reduction (vph)	0	0	73	0	0	107	0	0	65	0	84	0
Lane Group Flow (vph)	94	428	66	78	328	32	339	267	29	528	89	0
Turn Type	pm+pt			Perm	pm+pt		Perm	Split		Perm	Split	
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases	2		2	6		6			8			
Actuated Green, G (s)	24.8	20.0	20.0	24.8	20.0	20.0	26.4	26.4	26.4	20.3	20.3	
Effective Green, g (s)	25.8	20.9	20.9	25.8	20.9	20.9	27.3	27.3	27.3	20.9	20.9	
Actuated g/C Ratio	0.29	0.23	0.23	0.29	0.23	0.23	0.30	0.30	0.30	0.23	0.23	
Clearance Time (s)	4.1	4.9	4.9	4.1	4.9	4.9	4.9	4.9	4.9	4.6	4.6	
Vehicle Extension (s)	2.5	4.7	4.7	2.5	4.6	4.6	5.2	5.2	5.2	6.2	6.2	
Lane Grp Cap (vph)	298	822	368	253	822	368	537	565	480	797	389	
v/s Ratio Prot	c0.02	c0.12		0.02	0.09		c0.19	0.14		c0.15	0.05	
v/s Ratio Perm	0.07		0.04	0.07		0.02			0.02			
v/c Ratio	0.32	0.52	0.18	0.31	0.40	0.09	0.63	0.47	0.06	0.66	0.23	
Uniform Delay, d1	24.3	30.2	27.7	24.2	29.2	27.1	27.0	25.5	22.2	31.3	28.0	
Progression Factor	0.82	0.80	0.94	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	2.1	0.9	0.5	1.4	0.5	5.6	2.8	0.2	4.3	1.4	
Delay (s)	20.2	26.4	26.9	24.7	30.7	27.5	32.6	28.3	22.5	35.7	29.4	
Level of Service	C	C	C	C	C	C	C	C	C	D	C	
Approach Delay (s)		25.6			29.0			29.6			34.1	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay		29.7		HCM Level of Service	C							
HCM Volume to Capacity ratio		0.59										
Actuated Cycle Length (s)		90.0		Sum of lost time (s)	16.0							
Intersection Capacity Utilization		55.2%		ICU Level of Service	B							
Analysis Period (min)		15										
c Critical Lane Group												

LSC, Inc. (BP)
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HCM Signalized Intersection Capacity Analysis
Page 4























HCM Unsignalized Intersection Capacity Analysis
5: Main Street & Mountain Boulevard

Saturday Peak - Base
9/23/2010

																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR								
Lane Configurations																				
Sign Control	Free			Free			Stop			Stop										
Grade	0%			0%			0%			0%										
Volume (veh/h)	20	930	35	15	435	30	5	5	10	20	5	20								
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90								
Hourly flow rate (vph)	22	1033	39	17	483	33	6	6	11	22	6	22								
Pedestrians																				
Lane Width (ft)																				
Walking Speed (ft/s)																				
Percent Blockage																				
Right turn flare (veh)																				
Median type	None						None													
Median storage (veh)																				
Upstream signal (ft)																				
pX, platoon unblocked																				
vC, conflicting volume	517				1072				1397	1647	536	1108	1650	258						
vC1, stage 1 conf vol																				
vC2, stage 2 conf vol																				
vCu, unblocked vol	517				1072				1397	1647	536	1108	1650	258						
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5	6.5	6.9						
tC, 2 stage (s)																				
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5	4.0	3.3						
p0 queue free %	98				97				94	94	98	85	94	97						
cM capacity (veh/h)	1045				646				90	94	489	148	93	741						
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1														
Volume Total	539	556	258	275	22	50														
Volume Left	22	0	17	0	6	22														
Volume Right	0	39	0	33	11	22														
cSH	1045	1700	646	1700	154	209														
Volume to Capacity	0.02	0.33	0.03	0.16	0.14	0.24														
Queue Length 95th (ft)	2	0	2	0	12	23														
Control Delay (s)	0.6	0.0	1.0	0.0	32.2	27.6														
Lane LOS	A	A		D		D														
Approach Delay (s)	0.3	0.5		32.2		27.6														
Approach LOS					D	D														
Intersection Summary																				
Average Delay	1.6																			
Intersection Capacity Utilization	52.3%			ICU Level of Service			A													
Analysis Period (min)	15																			




















HCM Unsignalized Intersection Capacity Analysis
6: Main Street & Center Street

Saturday Peak - Base
9/23/2010

																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR								
Lane Configurations		 			 			 			 									
Sign Control		Free			Free			Stop			Stop									
Grade		0%			0%			0%			0%									
Volume (veh/h)	50	715	55	25	485	35	25	5	55	25	0	20								
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90								
Hourly flow rate (vph)	56	794	61	28	539	39	28	6	61	28	0	22								
Pedestrians																				
Lane Width (ft)																				
Walking Speed (ft/s)																				
Percent Blockage																				
Right turn flare (veh)																				
Median type							None			None										
Median storage (veh)																				
Upstream signal (ft)	1207																			
pX, platoon unblocked																				
vC, conflicting volume	578				856				1283	1569	428	1186								
vC1, stage 1 conf vol																				
vC2, stage 2 conf vol																				
vCu, unblocked vol	578				856				1283	1569	428	1186								
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5								
tC, 2 stage (s)																				
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5								
p0 queue free %	94				96				75	94	89	76								
cM capacity (veh/h)	992				780				110	100	575	115								
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1												
Volume Total	56	530	326	28	359	219	94	50												
Volume Left	56	0	0	28	0	0	28	28												
Volume Right	0	0	61	0	0	39	61	22												
cSH	992	1700	1700	780	1700	1700	228	183												
Volume to Capacity	0.06	0.31	0.19	0.04	0.21	0.13	0.41	0.27												
Queue Length 95th (ft)	4	0	0	3	0	0	48	26												
Control Delay (s)	8.8	0.0	0.0	9.8	0.0	0.0	31.5	31.9												
Lane LOS	A			A			D	D												
Approach Delay (s)	0.5			0.4			31.5	31.9												
Approach LOS							D	D												
Intersection Summary																				
Average Delay	3.2																			
Intersection Capacity Utilization	40.2%			ICU Level of Service			A													
Analysis Period (min)	15																			

HCM Unsignalized Intersection Capacity Analysis
7: Main Street & Forest Trail

Saturday Peak - Base
9/23/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	15	870	15	15	535	60	15	0	20	125	5	30
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	17	967	17	17	594	67	17	0	22	139	6	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												1
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)				793								
pX, platoon unblocked												
vC, conflicting volume	661			983			1342	1703	492	1200	1678	331
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	661			983			1342	1703	492	1200	1678	331
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			98			83	100	96	0	94	95
cM capacity (veh/h)	923			698			97	87	523	130	90	665
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	17	644	339	17	396	265	39	178				
Volume Left	17	0	0	17	0	0	17	139				
Volume Right	0	0	17	0	0	67	22	33				
cSH	923	1700	1700	698	1700	1700	181	152				
Volume to Capacity	0.02	0.38	0.20	0.02	0.23	0.16	0.21	1.17				
Queue Length 95th (ft)	1	0	0	2	0	0	20	248				
Control Delay (s)	9.0	0.0	0.0	10.3	0.0	0.0	30.2	184.6				
Lane LOS	A			B			D	F				
Approach Delay (s)	0.1			0.3			30.2	184.6				
Approach LOS							D	F				
Intersection Summary												
Average Delay	18.1											
Intersection Capacity Utilization	45.0%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
8: Main Street & Laurel Mountain Road

Saturday Peak - Base
9/23/2010

	→	↗	↖	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↖	↗
Sign Control	Free		Free	Free	Stop	
Grade	0%		0%	0%		
Volume (veh/h)	840	165	20	545	95	30
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	933	183	22	606	106	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)	505					
pX, platoon unblocked						
vC, conflicting volume			1117		1372	558
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1117		1372	558
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		20	93
cM capacity (veh/h)			621		132	473
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	622	494	22	303	303	139
Volume Left	0	0	22	0	0	106
Volume Right	0	183	0	0	0	33
cSH	1700	1700	621	1700	1700	160
Volume to Capacity	0.37	0.29	0.04	0.18	0.18	0.87
Queue Length 95th (ft)	0	0	3	0	0	151
Control Delay (s)	0.0	0.0	11.0	0.0	0.0	96.6
Lane LOS			B			F
Approach Delay (s)	0.0		0.4			96.6
Approach LOS						F
Intersection Summary						
Average Delay	7.3					
Intersection Capacity Utilization	42.2%			ICU Level of Service		
Analysis Period (min)	15					

HCM Signalized Intersection Capacity Analysis
9: Main Street & Old Mammoth Road

Saturday Peak - Base
9/23/2010

	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↘	↑↑	↘	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	1770	1583
Flt Permitted	1.00	1.00	0.43	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	805	3539	1770	1583
Volume (vph)	310	560	90	230	310	70
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	344	622	100	256	344	78
RTOR Reduction (vph)	0	433	0	0	0	47
Lane Group Flow (vph)	344	189	100	256	344	31
Turn Type	Perm		pm+pt	Perm		
Protected Phases	2	1		6	3	
Permitted Phases	2		6	3		
Actuated Green, G (s)	16.4	16.4	25.0	25.0	22.3	22.3
Effective Green, g (s)	17.3	17.3	25.9	25.9	22.9	22.9
Actuated g/C Ratio	0.30	0.30	0.46	0.46	0.40	0.40
Clearance Time (s)	4.9	4.9	4.1	4.9	4.6	4.6
Vehicle Extension (s)	5.2	5.2	2.5	5.2	5.2	5.2
Lane Grp Cap (vph)	1078	482	445	1614	714	638
v/s Ratio Prot	0.10	c0.02		0.07	c0.19	
v/s Ratio Perm	c0.12		0.08	0.02		
v/c Ratio	0.32	0.39	0.22	0.16	0.48	0.05
Uniform Delay, d1	15.2	15.6	9.1	9.1	12.6	10.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	1.2	0.2	0.1	2.3	0.1
Delay (s)	15.6	16.8	9.3	9.2	14.9	10.5
Level of Service	B	B	A	A	B	B
Approach Delay (s)	16.4			9.2	14.1	
Approach LOS	B			A	B	
Intersection Summary						
HCM Average Control Delay	14.3		HCM Level of Service		B	
HCM Volume to Capacity ratio	0.42					
Actuated Cycle Length (s)	56.8		Sum of lost time (s)		12.0	
Intersection Capacity Utilization	46.3%		ICU Level of Service		A	
Analysis Period (min)	15					
c Critical Lane Group						


















HCM Unsignalized Intersection Capacity Analysis
10: Main Street & Sierra Park Boulevard

Saturday Peak - Base
9/23/2010

	↖	→	↗	↖	←	↖	↗	↑	↖	↗	↓	↖	↗
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↖	↕↕		↖	↕↕			↕↕			↕↕		
Sign Control		Free			Free			Stop			Stop		
Grade		0%			0%			0%			0%		
Volume (veh/h)	10	320	55	25	265	5	25	5	30	5	5	10	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	11	356	61	28	294	6	28	6	33	6	6	11	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type								None			None		
Median storage (veh)													
Upstream signal (ft)		544											
pX, platoon unblocked				0.98			0.98	0.98	0.98	0.98	0.98		
vC, conflicting volume	300			417			625	764	208	589	792	150	
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	300			378			592	734	165	555	762	150	
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9	
tC, 2 stage (s)													
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3	
p0 queue free %	99			98			92	98	96	99	98	99	
cM capacity (veh/h)	1258			1149			362	327	830	374	314	870	
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1					
Volume Total	11	237	180	28	196	104	67	22					
Volume Left	11	0	0	28	0	0	28	6					
Volume Right	0	0	61	0	0	6	33	11					
cSH	1258	1700	1700	1149	1700	1700	498	491					
Volume to Capacity	0.01	0.14	0.11	0.02	0.12	0.06	0.13	0.05					
Queue Length 95th (ft)	1	0	0	2	0	0	12	4					
Control Delay (s)	7.9	0.0	0.0	8.2	0.0	0.0	13.4	12.7					
Lane LOS	A			A			B	B					
Approach Delay (s)	0.2			0.7			13.4	12.7					
Approach LOS							B	B					
Intersection Summary													
Average Delay				1.8									
Intersection Capacity Utilization			29.8%		ICU Level of Service					A			
Analysis Period (min)			15										

HCM Unsignalized Intersection Capacity Analysis
11: Tavern Road & Old Mammoth Road

Saturday Peak - Base
9/23/2010

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop		Free				Free	
Grade	0%				0%		0%				0%	
Volume (veh/h)	10	5	25	5	5	25	30	385	10	15	645	25
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	6	28	6	6	28	33	428	11	17	717	28
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	760											
pX, platoon unblocked												
vC, conflicting volume	1289	1269	731	1281	1278	433	744	439				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1289	1269	731	1281	1278	433	744	439				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	91	97	93	96	96	96	96	99				
cM capacity (veh/h)	125	159	422	124	157	622	863	1121				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	44	39	33	439	17	744						
Volume Left	11	6	33	0	17	0						
Volume Right	28	28	0	11	0	28						
cSH	235	312	863	1700	1121	1700						
Volume to Capacity	0.19	0.12	0.04	0.26	0.01	0.44						
Queue Length 95th (ft)	17	11	3	0	1	0						
Control Delay (s)	23.9	18.2	9.3	0.0	8.3	0.0						
Lane LOS	C	C	A		A							
Approach Delay (s)	23.9	18.2	0.7	0.2								
Approach LOS	C	C										
Intersection Summary												
Average Delay	1.7											
Intersection Capacity Utilization	46.1%		ICU Level of Service				A					
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
12: Sierra Nevada Road & Old Mammoth Road

Saturday Peak - Base
9/23/2010










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	15	10	65	15	15	25	55	385	5	35	585	35
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	17	11	72	17	17	28	61	428	6	39	650	39
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	773											
pX, platoon unblocked												
vC, conflicting volume	1333	1303	669	1358	1319	431	689	433				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1333	1303	669	1358	1319	431	689	433				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	84	92	84	82	88	96	93	97				
cM capacity (veh/h)	105	145	457	92	141	625	905	1126				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	100	61	61	433	39	689						
Volume Left	17	17	61	0	39	0						
Volume Right	72	28	0	6	0	39						
cSH	254	178	905	1700	1126	1700						
Volume to Capacity	0.39	0.34	0.07	0.25	0.03	0.41						
Queue Length 95th (ft)	44	36	5	0	3	0						
Control Delay (s)	28.0	35.4	9.3	0.0	8.3	0.0						
Lane LOS	D	E	A		A							
Approach Delay (s)	28.0	35.4	1.1	0.4								
Approach LOS	D	E										
Intersection Summary												
Average Delay	4.2											
Intersection Capacity Utilization	52.5%			ICU Level of Service				A				
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
13: Meridian Boulevard & Majestic Pines Drive

Saturday Peak - Base
9/23/2010






















						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control	Free	Free	Free		Stop	
Grade	0%	0%	0%		0%	
Volume (veh/h)	35	270	135	50	35	25
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	39	300	150	56	39	28
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	206				406	103
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	206				406	103
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				93	97
cM capacity (veh/h)	1363				557	932
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	139	200	100	106	67	
Volume Left	39	0	0	0	39	
Volume Right	0	0	0	56	28	
cSH	1363	1700	1700	1700	669	
Volume to Capacity	0.03	0.12	0.06	0.06	0.10	
Queue Length 95th (ft)	2	0	0	0	8	
Control Delay (s)	2.3	0.0	0.0	0.0	11.0	
Lane LOS	A				B	
Approach Delay (s)	1.0		0.0		11.0	
Approach LOS					B	
Intersection Summary						
Average Delay		1.7				
Intersection Capacity Utilization		27.3%		ICU Level of Service		A
Analysis Period (min)		15				

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
Page 13

HCM Signalized Intersection Capacity Analysis
14: Meridian Boulevard & Minaret Road

Saturday Peak - Base
9/23/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.94		1.00	0.98		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3437		1770	3319		1770	1829		1770	1810	
Flt Permitted	0.42	1.00		0.56	1.00		0.57	1.00		0.55	1.00	
Satd. Flow (perm)	791	3437		1042	3319		1053	1829		1027	1810	
Volume (vph)	95	230	55	20	140	100	30	110	15	215	235	55
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	106	256	61	22	156	111	33	122	17	239	261	61
RTOR Reduction (vph)	0	23	0	0	91	0	0	5	0	0	8	0
Lane Group Flow (vph)	106	294	0	22	176	0	33	134	0	239	314	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	20.0	14.9		11.1	10.1		20.0	18.0		30.3	24.2	
Effective Green, g (s)	20.9	15.8		12.1	11.0		21.0	18.9		31.2	25.1	
Actuated g/C Ratio	0.35	0.26		0.20	0.18		0.35	0.31		0.52	0.42	
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9		4.1	4.9	
Vehicle Extension (s)	2.5	5.0		2.5	5.0		2.5	5.0		2.5	5.0	
Lane Grp Cap (vph)	371	904		223	607		393	575		636	756	
v/s Ratio Prot	c0.03	c0.09		0.00	0.05		0.00	0.07		c0.05	c0.17	
v/s Ratio Perm	0.07			0.02			0.03			0.14		
v/c Ratio	0.29	0.33		0.10	0.29		0.08	0.23		0.38	0.42	
Uniform Delay, d1	13.8	17.9		19.4	21.2		13.0	15.2		8.2	12.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.4		0.1	0.6		0.1	0.4		0.3	0.8	
Delay (s)	14.1	18.3		19.6	21.7		13.0	15.7		8.5	13.1	
Level of Service	B	B		B	C		B	B		A	B	
Approach Delay (s)		17.2			21.6			15.2			11.1	
Approach LOS		B			C			B			B	
Intersection Summary												
HCM Average Control Delay		15.5			HCM Level of Service			B				
HCM Volume to Capacity ratio		0.36										
Actuated Cycle Length (s)		60.1			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		47.6%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis
15: Meridian Boulevard & Old Mammoth Road

Saturday Peak - Base
9/23/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3464		1770	3448		1770	1863	1583	1770	1863	1583
Flt Permitted	0.38	1.00		0.21	1.00		0.36	1.00	1.00	0.54	1.00	1.00
Satd. Flow (perm)	715	3464		384	3448		663	1863	1583	1008	1863	1583
Volume (vph)	175	635	105	90	340	70	120	215	45	110	275	55
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	194	706	117	100	378	78	133	239	50	122	306	61
RTOR Reduction (vph)	0	16	0	0	20	0	0	0	35	0	0	44
Lane Group Flow (vph)	194	807	0	100	436	0	133	239	15	122	306	17
Turn Type	pm+pt			pm+pt			pm+pt		Perm	pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	29.8	23.1		26.2	21.3		25.5	19.7	19.7	22.7	18.3	18.3
Effective Green, g (s)	30.8	24.0		27.2	22.2		26.5	20.6	20.6	23.7	19.2	19.2
Actuated g/C Ratio	0.44	0.34		0.39	0.32		0.38	0.29	0.29	0.34	0.27	0.27
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9	4.9	4.1	4.9	4.9
Vehicle Extension (s)	2.5	3.7		2.5	3.8		2.5	3.8	3.8	2.5	3.8	3.8
Lane Grp Cap (vph)	416	1186		248	1092		344	547	465	390	510	434
v/s Ratio Prot	c0.05	c0.23		0.03	0.13		c0.03	0.13		0.02	c0.16	
v/s Ratio Perm	0.16			0.13			0.11		0.01	0.09		0.01
v/c Ratio	0.47	0.68		0.40	0.40		0.39	0.44	0.03	0.31	0.60	0.04
Uniform Delay, d1	12.6	19.8		14.6	18.7		15.2	20.1	17.6	16.5	22.1	18.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	1.7		0.8	0.3		0.5	0.7	0.0	0.3	2.2	0.0
Delay (s)	13.2	21.5		15.4	19.0		15.7	20.8	17.7	16.9	24.3	18.7
Level of Service	B	C		B	B		B	C	B	B	C	B
Approach Delay (s)		19.9			18.4			18.8			21.8	
Approach LOS		B			B			B			C	
Intersection Summary												
HCM Average Control Delay		19.7			HCM Level of Service			B				
HCM Volume to Capacity ratio		0.62										
Actuated Cycle Length (s)		70.1			Sum of lost time (s)			16.0				
Intersection Capacity Utilization		60.4%			ICU Level of Service			B				
Analysis Period (min)		15										
c Critical Lane Group												

















HCM Unsignalized Intersection Capacity Analysis
16: Meridian Boulevard & Sierra Park Road

Saturday Peak - Base
9/23/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔	↔	↔	↔	↔
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	45	130	5	125	10	25	5	5	10	5	60	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	50	144	6	139	11	28	6	6	11	6	67	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total (vph)	122	78	75	81	39	83						
Volume Left (vph)	50	0	6	0	28	11						
Volume Right (vph)	0	6	0	11	6	67						
Hadj (s)	0.24	-0.02	0.07	-0.06	0.09	-0.42						
Departure Headway (s)	5.2	4.9	5.1	4.9	4.9	4.4						
Degree Utilization, x	0.18	0.11	0.11	0.11	0.05	0.10						
Capacity (veh/h)	677	707	684	705	680	763						
Control Delay (s)	8.1	7.3	7.4	7.3	8.2	7.8						
Approach Delay (s)	7.8		7.4		8.2	7.8						
Approach LOS	A		A		A	A						
Intersection Summary												
Delay		7.7										
HCM Level of Service		A										
Intersection Capacity Utilization		26.3%			ICU Level of Service					A		
Analysis Period (min)		15										

HCM Unsignalized Intersection Capacity Analysis
17: Chateau Road & Old Mammoth Road

Saturday Peak - Base
9/23/2010





















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	35	15	10	5	10	25	10	235	5	45	280	70
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	39	17	11	6	11	28	11	261	6	50	311	78
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	1037											
pX, platoon unblocked												
vC, conflicting volume	767	739	350	717	775	264	389	267				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	767	739	350	717	775	264	389	267				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	87	95	98	98	96	96	99	96				
cM capacity (veh/h)	289	329	693	314	313	775	1170	1297				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	67	44	11	267	50	389						
Volume Left	39	6	11	0	50	0						
Volume Right	11	28	0	6	0	78						
cSH	331	499	1170	1700	1297	1700						
Volume to Capacity	0.20	0.09	0.01	0.16	0.04	0.23						
Queue Length 95th (ft)	19	7	1	0	3	0						
Control Delay (s)	18.6	12.9	8.1	0.0	7.9	0.0						
Lane LOS	C	B	A		A							
Approach Delay (s)	18.6	12.9	0.3	0.9								
Approach LOS	C	B										
Intersection Summary												
Average Delay	2.8											
Intersection Capacity Utilization	42.3%			ICU Level of Service				A				
Analysis Period (min)	15											

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Mammoth Lakes (LSC#084870)
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HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
18: Old Mammoth Road & Minaret Road

Saturday Peak - Base
9/23/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	90	140	10	30	160	60	5	15	20	65	35	130
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	100	156	11	33	178	67	6	17	22	72	39	144
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	244			167			769	672	161	653	644	211
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	244			167			769	672	161	653	644	211
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	92			98			98	95	97	78	89	83
cM capacity (veh/h)	1322			1411			223	340	884	331	353	829
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	100	167	33	244	44	72	183					
Volume Left	100	0	33	0	6	72	0					
Volume Right	0	11	0	67	22	0	144					
cSH	1322	1700	1411	1700	622	331	645					
Volume to Capacity	0.08	0.10	0.02	0.14	0.07	0.22	0.28					
Queue Length 95th (ft)	6	0	2	0	6	20	29					
Control Delay (s)	7.9	0.0	7.6	0.0	13.3	18.9	12.8					
Lane LOS	A		A		B	C	B					
Approach Delay (s)	3.0		0.9		13.3	14.5						
Approach LOS					B	B						
Intersection Summary												
Average Delay			6.3									
Intersection Capacity Utilization			37.3%		ICU Level of Service					A		
Analysis Period (min)			15									

















LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
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HCM Unsignalized Intersection Capacity Analysis
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Future Conditions (Base) LOS Reports














HCM Unsignalized Intersection Capacity Analysis
1: Forest Trail & Minaret Road

Saturday Peak - Future
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop		Free				Free	
Grade	0%				0%		0%				0%	
Volume (veh/h)	25	35	105	25	20	15	80	195	40	100	745	115
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	28	39	117	28	22	17	89	217	44	111	828	128
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1558	1553	892	1667	1594	239	956			261		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1558	1553	892	1667	1594	239	956			261		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	55	57	66	4	74	98	88			91		
cM capacity (veh/h)	61	91	341	29	86	800	719			1303		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	183	67	350	1067								
Volume Left	28	28	89	111								
Volume Right	117	17	44	128								
cSH	150	54	719	1303								
Volume to Capacity	1.22	1.24	0.12	0.09								
Queue Length 95th (ft)	266	147	11	7								
Control Delay (s)	205.3	327.9	3.9	2.2								
Lane LOS	F	F	A	A								
Approach Delay (s)	205.3	327.9	3.9	2.2								
Approach LOS	F	F										
Intersection Summary												
Average Delay			37.9									
Intersection Capacity Utilization			73.9%		ICU Level of Service				D			
Analysis Period (min)			15									













HCM Unsignalized Intersection Capacity Analysis
2: Lake Mary Road & Davidson

Saturday Peak - Future
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Free				Free				Stop		Stop	
Grade	0%				0%				0%		0%	
Volume (veh/h)	0	105	15	80	105	40	10	0	65	60	0	5
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	117	17	89	117	44	11	0	72	67	0	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type								None		None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	161				133				447	464	125	478
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	161				133				447	464	125	478
tC, single (s)	4.1				4.1				7.1	6.5	6.2	7.1
tC, 2 stage (s)												
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5
p0 queue free %	100				94				98	100	92	85
cM capacity (veh/h)	1418				1451				494	465	926	437
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	133	250	83	72								
Volume Left	0	89	11	67								
Volume Right	17	44	72	6								
cSH	1418	1451	1068	456								
Volume to Capacity	0.00	0.06	0.08	0.16								
Queue Length 95th (ft)	0	5	6	14								
Control Delay (s)	0.0	3.1	9.6	14.4								
Lane LOS		A	A	B								
Approach Delay (s)	0.0	3.1	9.6	14.4								
Approach LOS			A	B								
Intersection Summary												
Average Delay				4.8								
Intersection Capacity Utilization	36.0%			ICU Level of Service					A			
Analysis Period (min)				15								

HCM Signalized Intersection Capacity Analysis
3: Lake Mary Road & Canyon Boulevard

Saturday Peak - Future
10/12/2010

























						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	1.00	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1770	1863	1863	1583	3431	
Flt Permitted	0.59	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1092	1863	1863	1583	3431	
Volume (vph)	25	220	255	235	495	15
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	28	244	283	261	550	17
RTOR Reduction (vph)	0	0	0	112	7	0
Lane Group Flow (vph)	28	244	283	149	560	0
Turn Type	Perm			Perm		
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	25.1	25.1	25.1	25.1	11.2	
Effective Green, g (s)	25.7	25.7	25.7	25.7	11.3	
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.25	
Clearance Time (s)	4.6	4.6	4.6	4.6	4.1	
Vehicle Extension (s)	6.1	6.1	6.1	6.1	2.0	
Lane Grp Cap (vph)	624	1064	1064	904	862	
v/s Ratio Prot		0.13	c0.15		c0.16	
v/s Ratio Perm	0.03			0.09		
v/c Ratio	0.04	0.23	0.27	0.16	0.65	
Uniform Delay, d1	4.2	4.8	4.9	4.6	15.1	
Progression Factor	1.00	1.00	0.41	0.61	1.00	
Incremental Delay, d2	0.1	0.5	0.4	0.3	1.3	
Delay (s)	4.4	5.3	2.4	3.1	16.4	
Level of Service	A	A	A	A	B	
Approach Delay (s)		5.2	2.7		16.4	
Approach LOS		A	A		B	
Intersection Summary						
HCM Average Control Delay		8.8		HCM Level of Service	A	
HCM Volume to Capacity ratio		0.38				
Actuated Cycle Length (s)		45.0		Sum of lost time (s)	8.0	
Intersection Capacity Utilization		42.0%		ICU Level of Service	A	
Analysis Period (min)		15				
c Critical Lane Group						

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
Page 3

HCM Signalized Intersection Capacity Analysis
4: Lake Mary Road & Minaret Road

Saturday Peak - Future
10/12/2010






















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.97	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90	0.90
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	3433	1680	1680
Flt Permitted	0.32	1.00	1.00	0.25	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	602	3539	1583	471	3539	1583	1770	1863	1583	3433	1680	1680
Volume (vph)	115	500	190	105	385	160	465	320	125	615	75	140
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	128	556	211	117	428	178	517	356	139	683	83	156
RTOR Reduction (vph)	0	0	85	0	0	140	0	0	94	0	75	0
Lane Group Flow (vph)	128	556	126	117	428	38	517	356	45	683	164	0
Turn Type	pm+pt			Perm	pm+pt		Perm	Split		Perm	Split	
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases	2		2	6		6			8			
Actuated Green, G (s)	25.6	19.6	19.6	23.2	18.4	18.4	27.1	27.1	27.1	20.0	20.0	
Effective Green, g (s)	26.6	20.5	20.5	24.2	19.3	19.3	28.0	28.0	28.0	20.6	20.6	
Actuated g/C Ratio	0.30	0.23	0.23	0.27	0.21	0.21	0.31	0.31	0.31	0.23	0.23	
Clearance Time (s)	4.1	4.9	4.9	4.1	4.9	4.9	4.9	4.9	4.9	4.6	4.6	
Vehicle Extension (s)	2.5	4.7	4.7	2.5	4.6	4.6	5.2	5.2	5.2	6.2	6.2	
Lane Grp Cap (vph)	257	806	361	197	759	339	551	580	492	786	385	
v/s Ratio Prot	c0.03	c0.16		0.03	0.12		c0.29	0.19		c0.20	0.10	
v/s Ratio Perm	0.11		0.08	0.13		0.02			0.03			
v/c Ratio	0.50	0.69	0.35	0.59	0.56	0.11	0.94	0.61	0.09	0.87	0.43	
Uniform Delay, d1	24.4	31.8	29.2	26.2	31.6	28.5	30.2	26.4	22.0	33.4	29.7	
Progression Factor	0.85	0.86	0.85	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	4.3	2.4	4.0	3.0	0.7	25.8	4.8	0.4	12.5	3.4	
Delay (s)	21.7	31.7	27.1	30.2	34.6	29.1	55.9	31.2	22.4	45.9	33.1	
Level of Service	C	C	C	C	C	C	E	C	C	D	C	
Approach Delay (s)		29.2			32.5			42.6			42.6	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM Average Control Delay		37.2		HCM Level of Service	D							
HCM Volume to Capacity ratio		0.79										
Actuated Cycle Length (s)		90.0		Sum of lost time (s)	12.0							
Intersection Capacity Utilization		71.3%		ICU Level of Service	C							
Analysis Period (min)		15										
c Critical Lane Group												

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
5: Main Street & Mountain Boulevard

Saturday Peak - Future
10/12/2010



















																	
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR					
Lane Configurations																	
Sign Control	Free			Free			Stop			Stop							
Grade	0%			0%			0%			0%							
Volume (veh/h)	25	1115	60	25	520	75	10	20	15	50	15	50					
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90					
Hourly flow rate (vph)	28	1239	67	28	578	83	11	22	17	56	17	56					
Pedestrians																	
Lane Width (ft)																	
Walking Speed (ft/s)																	
Percent Blockage																	
Right turn flare (veh)																	
Median type	None						None										
Median storage (veh)																	
Upstream signal (ft)																	
pX, platoon unblocked																	
vC, conflicting volume	661			1306			1736	2044	653	1378	2036	331					
vC1, stage 1 conf vol																	
vC2, stage 2 conf vol																	
vCu, unblocked vol	661			1306			1736	2044	653	1378	2036	331					
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9					
tC, 2 stage (s)																	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3					
p0 queue free %	97			95			69	56	96	10	68	92					
cM capacity (veh/h)	923			526			36	51	410	62	52	665					
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1											
Volume Total	647	686	317	372	50	128											
Volume Left	28	0	28	0	11	56											
Volume Right	0	67	0	83	17	56											
cSH	923	1700	526	1700	64	98											
Volume to Capacity	0.03	0.40	0.05	0.22	0.78	1.30											
Queue Length 95th (ft)	2	0	4	0	89	226											
Control Delay (s)	0.8	0.0	1.8	0.0	161.8	271.7											
Lane LOS	A		A		F	F											
Approach Delay (s)	0.4		0.8		161.8	271.7											
Approach LOS					F	F											
Intersection Summary																	
Average Delay	19.9																
Intersection Capacity Utilization	69.5%																
ICU Level of Service	C																
Analysis Period (min)	15																

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
6: Main Street & Center Street

Saturday Peak - Future
10/12/2010




















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	55	790	110	50	535	55	50	10	110	40	0	30
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	61	878	122	56	594	61	56	11	122	44	0	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)	1207											
pX, platoon unblocked												
vC, conflicting volume	656			1000			1503	1828	500	1425	1858	328
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	656			1000			1503	1828	500	1425	1858	328
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	93			92			22	83	76	22	100	95
cM capacity (veh/h)	928			688			71	65	516	57	62	668
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	61	585	415	56	396	259	189	78				
Volume Left	61	0	0	56	0	0	56	44				
Volume Right	0	0	122	0	0	61	122	33				
cSH	928	1700	1700	688	1700	1700	159	94				
Volume to Capacity	0.07	0.34	0.24	0.08	0.23	0.15	1.19	0.83				
Queue Length 95th (ft)	5	0	0	7	0	0	263	113				
Control Delay (s)	9.2	0.0	0.0	10.7	0.0	0.0	188.4	131.4				
Lane LOS	A			B			F	F				
Approach Delay (s)	0.5			0.8			188.4	131.4				
Approach LOS							F	F				
Intersection Summary												
Average Delay	23.0											
Intersection Capacity Utilization	49.2%											
ICU Level of Service	A											
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
7: Main Street & Forest Trail

Saturday Peak - Future
10/12/2010

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Sign Control	Free			Free				Stop			Stop		
Grade	0%			0%				0%			0%		
Volume (veh/h)	15	995	15	15	610	80	15	0	20	170	5	40	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	17	1106	17	17	678	89	17	0	22	189	6	44	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)												1	
Median type							None			None			
Median storage (veh)													
Upstream signal (ft)	793												
pX, platoon unblocked													
vC, conflicting volume	767			1122				1522	1947	561	1364	1911	383
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	767			1122				1522	1947	561	1364	1911	383
tC, single (s)	4.1			4.1				7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			2.2				3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			97				75	100	95	0	91	93
cM capacity (veh/h)	843			618				68	61	471	98	64	615
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1					
Volume Total	17	737	385	17	452	315	39	239					
Volume Left	17	0	0	17	0	0	17	189					
Volume Right	0	0	17	0	0	89	22	44					
cSH	843	1700	1700	618	1700	1700	133	114					
Volume to Capacity	0.02	0.43	0.23	0.03	0.27	0.19	0.29	2.09					
Queue Length 95th (ft)	2	0	0	2	0	0	28	501					
Control Delay (s)	9.4	0.0	0.0	11.0	0.0	0.0	43.0	580.0					
Lane LOS	A			B				E	F				
Approach Delay (s)	0.1			0.2				43.0	580.0				
Approach LOS							E	F					
Intersection Summary													
Average Delay	63.9												
Intersection Capacity Utilization	51.0%			ICU Level of Service					A				
Analysis Period (min)	15												

HCM Unsignalized Intersection Capacity Analysis
8: Main Street & Laurel Mountain Road

Saturday Peak - Future
10/12/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↓		↱	↑↑	↲	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	965	200	25	625	115	35
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1072	222	28	694	128	39
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)	505					
pX, platoon unblocked						
vC, conflicting volume			1294	1586		647
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1294	1586		647
tC, single (s)			4.1	6.8		6.9
tC, 2 stage (s)						
tF (s)			2.2	3.5		3.3
p0 queue free %			95	0		91
cM capacity (veh/h)			531	94		414
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	715	580	28	347	347	167
Volume Left	0	0	28	0	0	128
Volume Right	0	222	0	0	0	39
cSH	1700	1700	531	1700	1700	114
Volume to Capacity	0.42	0.34	0.05	0.20	0.20	1.46
Queue Length 95th (ft)	0	0	4	0	0	296
Control Delay (s)	0.0	0.0	12.1	0.0	0.0	316.3
Lane LOS	B			F		
Approach Delay (s)	0.0	0.5		316.3		
Approach LOS				F		
Intersection Summary						
Average Delay	24.3					
Intersection Capacity Utilization	48.2%		ICU Level of Service			A
Analysis Period (min)	15					

HCM Signalized Intersection Capacity Analysis
9: Main Street & Old Mammoth Road

Saturday Peak - Future
10/12/2010




















	→	↗	↖	←	↙	↘
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	1770	1583
Flt Permitted	1.00	1.00	0.40	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	752	3539	1770	1583
Volume (vph)	345	620	100	255	345	75
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	383	689	111	283	383	83
RTOR Reduction (vph)	0	477	0	0	0	50
Lane Group Flow (vph)	383	212	111	283	383	33
Turn Type	Perm		pm+pt		Perm	
Protected Phases	2		1		6	3
Permitted Phases		2	6			3
Actuated Green, G (s)	16.7	16.7	25.3	25.3	22.4	22.4
Effective Green, g (s)	17.6	17.6	26.2	26.2	23.0	23.0
Actuated g/C Ratio	0.31	0.31	0.46	0.46	0.40	0.40
Clearance Time (s)	4.9	4.9	4.1	4.9	4.6	4.6
Vehicle Extension (s)	5.2	5.2	2.5	5.2	5.2	5.2
Lane Grp Cap (vph)	1089	487	426	1621	712	637
v/s Ratio Prot	0.11		c0.02	0.08	c0.22	
v/s Ratio Perm		c0.13	0.10			0.02
v/c Ratio	0.35	0.44	0.26	0.17	0.54	0.05
Uniform Delay, d1	15.4	15.8	9.2	9.1	13.0	10.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	1.4	0.2	0.1	2.9	0.2
Delay (s)	15.8	17.2	9.4	9.2	15.9	10.6
Level of Service	B	B	A	A	B	B
Approach Delay (s)	16.7			9.3	15.0	
Approach LOS	B			A	B	
Intersection Summary						
HCM Average Control Delay		14.8		HCM Level of Service		B
HCM Volume to Capacity ratio		0.47				
Actuated Cycle Length (s)		57.2		Sum of lost time (s)		12.0
Intersection Capacity Utilization		50.6%		ICU Level of Service		A
Analysis Period (min)		15				
c Critical Lane Group						

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
10: Main Street & Sierra Park Boulevard

Saturday Peak - Future
10/12/2010


















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	10	345	85	40	285	10	40	10	45	10	10	15
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	383	94	44	317	11	44	11	50	11	11	17
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)		544										
pX, platoon unblocked				0.96			0.96	0.96	0.96	0.96	0.96	
vC, conflicting volume	328			478			722	869	239	681	911	164
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	328			415			670	823	167	626	866	164
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			96			85	96	94	96	96	98
cM capacity (veh/h)	1229			1095			301	280	815	310	264	852
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	11	256	222	44	211	117	106	39				
Volume Left	11	0	0	44	0	0	44	11				
Volume Right	0	0	94	0	0	11	50	17				
cSH	1229	1700	1700	1095	1700	1700	424	399				
Volume to Capacity	0.01	0.15	0.13	0.04	0.12	0.07	0.25	0.10				
Queue Length 95th (ft)	1	0	0	3	0	0	24	8				
Control Delay (s)	8.0	0.0	0.0	8.4	0.0	0.0	16.3	15.0				
Lane LOS	A			A			C	B				
Approach Delay (s)	0.2			1.0			16.3	15.0				
Approach LOS							C	B				
Intersection Summary												
Average Delay				2.7								
Intersection Capacity Utilization			34.2%		ICU Level of Service					A		
Analysis Period (min)			15									

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
11: Tavern Road & Old Mammoth Road

Saturday Peak - Future
10/12/2010


















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop		Free				Free	
Grade	0%				0%		0%				0%	
Volume (veh/h)	20	5	40	5	5	25	45	450	10	15	790	40
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	6	44	6	6	28	50	500	11	17	878	44
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	760											
pX, platoon unblocked												
vC, conflicting volume	1564	1544	900	1564	1561	506	922	511				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1564	1544	900	1564	1561	506	922	511				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	71	95	87	92	95	95	93	98				
cM capacity (veh/h)	77	105	337	71	103	567	741	1054				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	72	39	50	511	17	922						
Volume Left	22	6	50	0	17	0						
Volume Right	44	28	0	11	0	44						
cSH	153	214	741	1700	1054	1700						
Volume to Capacity	0.47	0.18	0.07	0.30	0.02	0.54						
Queue Length 95th (ft)	55	16	5	0	1	0						
Control Delay (s)	47.9	25.5	10.2	0.0	8.5	0.0						
Lane LOS	E	D	B		A							
Approach Delay (s)	47.9	25.5	0.9	0.2								
Approach LOS	E	D										
Intersection Summary												
Average Delay	3.2											
Intersection Capacity Utilization	57.9%			ICU Level of Service				B				
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
12: Sierra Nevada Road & Old Mammoth Road

Saturday Peak - Future
10/12/2010










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free				Free	
Grade	0%			0%			0%				0%	
Volume (veh/h)	20	15	85	20	20	35	75	480	5	50	715	50
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	17	94	22	22	39	83	533	6	56	794	56
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	773											
pX, platoon unblocked	0.95	0.95		0.95	0.95	0.95				0.95		
vC, conflicting volume	1683	1639	822	1711	1664	536	850				539	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1718	1672	822	1748	1698	512	850				515	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	48	78	75	37	70	93	89				94	
cM capacity (veh/h)	42	77	374	35	74	534	788				999	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	133	83	83	539	56	850						
Volume Left	22	22	83	0	56	0						
Volume Right	94	39	0	6	0	56						
cSH	134	83	788	1700	999	1700						
Volume to Capacity	0.99	1.00	0.11	0.32	0.06	0.50						
Queue Length 95th (ft)	175	140	9	0	4	0						
Control Delay (s)	139.7	188.4	10.1	0.0	8.8	0.0						
Lane LOS	F	F	B	A								
Approach Delay (s)	139.7	188.4	1.4	0.5								
Approach LOS	F	F										
Intersection Summary												
Average Delay	20.4											
Intersection Capacity Utilization	63.2%			ICU Level of Service				B				
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
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HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
13: Meridian Boulevard & Majestic Pines Drive

Saturday Peak - Future
10/12/2010
























						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	60	455	225	70	50	35
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	67	506	250	78	56	39
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	328				675	164
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	328				675	164
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				85	95
cM capacity (veh/h)	1229				366	852
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	235	337	167	161	94	
Volume Left	67	0	0	0	56	
Volume Right	0	0	0	78	39	
cSH	1229	1700	1700	1700	479	
Volume to Capacity	0.05	0.20	0.10	0.09	0.20	
Queue Length 95th (ft)	4	0	0	0	18	
Control Delay (s)	2.6	0.0	0.0	0.0	14.4	
Lane LOS	A				B	
Approach Delay (s)	1.1		0.0		14.4	
Approach LOS					B	
Intersection Summary						
Average Delay	2.0					
Intersection Capacity Utilization	37.7%		ICU Level of Service		A	
Analysis Period (min)	15					

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis
14: Meridian Boulevard & Minaret Road

Saturday Peak - Future
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.94		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3415		1770	3309		1770	1826		1770	1819	
Flt Permitted	0.33	1.00		0.38	1.00		0.31	1.00		0.41	1.00	
Satd. Flow (perm)	609	3415		714	3309		570	1826		765	1819	
Volume (vph)	150	345	105	35	210	160	60	195	30	345	480	90
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	167	383	117	39	233	178	67	217	33	383	533	100
RTOR Reduction (vph)	0	31	0	0	139	0	0	6	0	0	8	0
Lane Group Flow (vph)	167	469	0	39	272	0	67	244	0	383	625	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	24.5	18.7		18.9	15.9		25.3	22.3		41.6	34.5	
Effective Green, g (s)	25.5	19.6		19.9	16.8		26.3	23.2		42.5	35.4	
Actuated g/C Ratio	0.33	0.25		0.26	0.22		0.34	0.30		0.55	0.46	
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9		4.1	4.9	
Vehicle Extension (s)	2.5	5.0		2.5	5.0		2.5	5.0		2.5	5.0	
Lane Grp Cap (vph)	290	867		226	720		242	549		620	834	
v/s Ratio Prot	c0.04	0.14		0.01	0.08		0.01	0.13		c0.12	c0.34	
v/s Ratio Perm	c0.15			0.04			0.08			0.22		
v/c Ratio	0.58	0.54		0.17	0.38		0.28	0.45		0.62	0.75	
Uniform Delay, d1	19.5	24.9		21.8	25.7		17.7	21.8		10.7	17.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.3	1.2		0.3	0.7		0.5	1.2		1.6	4.5	
Delay (s)	21.8	26.1		22.1	26.4		18.2	23.0		12.3	21.7	
Level of Service	C	C		C	C		B	C		B	C	
Approach Delay (s)	25.0			26.1			22.0			18.2		
Approach LOS	C			C			C			B		
Intersection Summary												
HCM Average Control Delay	22.0			HCM Level of Service						C		
HCM Volume to Capacity ratio	0.72											
Actuated Cycle Length (s)	77.2			Sum of lost time (s)						16.0		
Intersection Capacity Utilization	68.3%			ICU Level of Service						C		
Analysis Period (min)	15											
c Critical Lane Group												

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis
15: Meridian Boulevard & Old Mammoth Road

Saturday Peak - Future
10/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flt	1.00	0.98		1.00	0.97		1.00	1.00		0.85	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3456		1770	3445		1770	1863		1583	1770	1863
Flt Permitted	0.34	1.00		0.16	1.00		0.25	1.00		0.44	1.00	1.00
Satd. Flow (perm)	632	3456		307	3445		463	1863		1583	811	1863
Volume (vph)	190	695	130	110	370	80	150	265	55	130	360	65
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	211	772	144	122	411	89	167	294	61	144	400	72
RTOR Reduction (vph)	0	17	0	0	20	0	0	0	43	0	0	50
Lane Group Flow (vph)	211	899	0	122	480	0	167	294	18	144	400	22
Turn Type	pm+pt			pm+pt			pm+pt		Perm	pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	33.8	25.9		28.8	23.4		27.7	22.2	22.2	26.1	21.4	21.4
Effective Green, g (s)	34.8	26.8		29.8	24.3		28.7	23.1	23.1	27.1	22.3	22.3
Actuated g/C Ratio	0.46	0.35		0.39	0.32		0.38	0.30	0.30	0.36	0.29	0.29
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9	4.9	4.1	4.9	4.9
Vehicle Extension (s)	2.5	3.7		2.5	3.8		2.5	3.8	3.8	2.5	3.8	3.8
Lane Grp Cap (vph)	408	1215		226	1099		270	565	480	349	545	463
v/s Ratio Prot	c0.05	c0.26		0.04	0.14		c0.05	0.16		0.03	c0.21	
v/s Ratio Perm	0.18			0.17			0.19		0.01	0.12		0.01
v/c Ratio	0.52	0.74		0.54	0.44		0.62	0.52	0.04	0.41	0.73	0.05
Uniform Delay, d1	13.2	21.6		16.3	20.5		17.5	22.0	18.7	17.5	24.3	19.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	2.6		1.9	0.4		3.6	1.1	0.0	0.6	5.4	0.1
Delay (s)	14.1	24.2		18.2	20.9		21.1	23.0	18.8	18.0	29.6	19.4
Level of Service	B	C		B	C		C	C	B	B	C	B
Approach Delay (s)		22.3			20.4			21.9			25.7	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay		22.6			HCM Level of Service			C				
HCM Volume to Capacity ratio		0.73										
Actuated Cycle Length (s)		76.2			Sum of lost time (s)			16.0				
Intersection Capacity Utilization		70.0%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
16: Meridian Boulevard & Sierra Park Road

Saturday Peak - Future
10/12/2010


















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	50	160	5	155	15	25	5	15	5	15	5	80
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	56	178	6	172	17	28	6	6	17	6	6	89
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total (vph)	144	94	92	103	39	111						
Volume Left (vph)	56	0	6	0	28	17						
Volume Right (vph)	0	6	0	17	6	89						
Hadj (s)	0.23	-0.01	0.06	-0.08	0.09	-0.42						
Departure Headway (s)	5.3	5.1	5.2	5.0	5.1	4.5						
Degree Utilization, x	0.21	0.13	0.13	0.14	0.06	0.14						
Capacity (veh/h)	651	685	665	687	642	729						
Control Delay (s)	8.5	7.6	7.8	7.7	8.4	8.3						
Approach Delay (s)	8.2		7.7		8.4	8.3						
Approach LOS	A		A		A	A						
Intersection Summary												
Delay		8.1										
HCM Level of Service		A										
Intersection Capacity Utilization		27.7%			ICU Level of Service					A		
Analysis Period (min)		15										

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
17: Chateau Road & Old Mammoth Road

Saturday Peak - Future
10/12/2010





















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop		Free				Free	
Grade	0%				0%		0%				0%	
Volume (veh/h)	35	35	15	10	20	60	15	340	10	110	405	85
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	39	39	17	11	22	67	17	378	11	122	450	94
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)												1037
pX, platoon unblocked	0.93	0.93	0.93	0.93	0.93		0.93					
vC, conflicting volume	1231	1164	497	1147	1206	383	544	389				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1249	1177	458	1159	1222	383	509	389				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	61	75	97	90	85	90	98	90				
cM capacity (veh/h)	101	156	559	115	147	664	980	1170				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	94	100	17	389	122	544						
Volume Left	39	11	17	0	122	0						
Volume Right	17	67	0	11	0	94						
cSH	142	287	980	1700	1170	1700						
Volume to Capacity	0.67	0.35	0.02	0.23	0.10	0.32						
Queue Length 95th (ft)	92	38	1	0	9	0						
Control Delay (s)	70.3	24.1	8.7	0.0	8.4	0.0						
Lane LOS	F	C	A		A							
Approach Delay (s)	70.3	24.1	0.4		1.5							
Approach LOS	F	C										
Intersection Summary												
Average Delay	8.1											
Intersection Capacity Utilization	51.2%		ICU Level of Service				A					
Analysis Period (min)	15											

LSC, Inc. (BP)
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LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
18: Old Mammoth Road & Minaret Road

Saturday Peak - Future
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	115	190	55	170	220	105	30	85	115	115	200	215
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	128	211	61	189	244	117	33	94	128	128	222	239
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type									None	None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	361			272			1469	1236	242	1258	1208	303
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	361			272			1469	1236	242	1258	1208	303
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	89			85			0	30	84	0	0	68
cM capacity (veh/h)	1198			1291			0	134	797	45	140	737
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	128	272	189	361	256	128	461					
Volume Left	128	0	189	0	33	128	0					
Volume Right	0	61	0	117	128	0	239					
cSH	1198	1700	1291	1700	40	45	241					
Volume to Capacity	0.11	0.16	0.15	0.21	6.44	2.85	1.92					
Queue Length 95th (ft)	9	0	13	0	Err	346	821					
Control Delay (s)	8.4	0.0	8.3	0.0	Err	1024.7	461.9					
Lane LOS	A		A		F	F	F					
Approach Delay (s)	2.7		2.8		Err	584.0						
Approach LOS					F	F						
Intersection Summary												
Average Delay	1617.1											
Intersection Capacity Utilization	65.1%			ICU Level of Service					C			
Analysis Period (min)	15											













LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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Future - Alternative 1 LOS Reports














HCM Unsignalized Intersection Capacity Analysis
1: Forest Trail & Minaret Road

Saturday Peak - Alternative 1
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕				↕			↕			↕	
Sign Control	Stop				Stop			Free			Free	
Grade	0%				0%			0%			0%	
Volume (veh/h)	20	30	100	20	15	10	75	195	30	80	745	110
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	33	111	22	17	11	83	217	33	89	828	122
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1486	1483	889	1594	1528	233	950	250				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1486	1483	889	1594	1528	233	950	250				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	71	68	68	42	83	99	88	93				
cM capacity (veh/h)	76	103	342	38	97	806	723	1316				
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	167	50	333	1039								
Volume Left	22	22	83	89								
Volume Right	111	11	33	122								
cSH	177	65	723	1316								
Volume to Capacity	0.94	0.77	0.12	0.07								
Queue Length 95th (ft)	182	87	10	5								
Control Delay (s)	105.2	156.4	3.7	1.8								
Lane LOS	F	F	A	A								
Approach Delay (s)	105.2	156.4	3.7	1.8								
Approach LOS	F	F										
Intersection Summary												
Average Delay			17.9									
Intersection Capacity Utilization			70.3%	ICU Level of Service					C			
Analysis Period (min)			15									













HCM Unsignalized Intersection Capacity Analysis
2: Lake Mary Road & Davidson

Saturday Peak - Alternative 1
10/12/2010

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Sign Control	Free				Free				Stop		Stop			
Grade	0%				0%				0%		0%			
Volume (veh/h)	0	105	15	80	105	40	10	0	65	60	0	5		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90		
Hourly flow rate (vph)	0	117	17	89	117	44	11	0	72	67	0	6		
Pedestrians														
Lane Width (ft)														
Walking Speed (ft/s)														
Percent Blockage														
Right turn flare (veh)									2					
Median type									None		None			
Median storage (veh)														
Upstream signal (ft)														
pX, platoon unblocked														
vC, conflicting volume	161					133			447	464	125	478	450	139
vC1, stage 1 conf vol														
vC2, stage 2 conf vol														
vCu, unblocked vol	161					133			447	464	125	478	450	139
tC, single (s)	4.1					4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)														
tF (s)	2.2					2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100					94			98	100	92	85	100	99
cM capacity (veh/h)	1418					1451			494	465	926	437	474	909
Direction, Lane #	EB 1	WB 1	NB 1	SB 1										
Volume Total	133	250	83	72										
Volume Left	0	89	11	67										
Volume Right	17	44	72	6										
cSH	1418	1451	1068	456										
Volume to Capacity	0.00	0.06	0.08	0.16										
Queue Length 95th (ft)	0	5	6	14										
Control Delay (s)	0.0	3.1	9.6	14.4										
Lane LOS		A	A	B										
Approach Delay (s)	0.0	3.1	9.6	14.4										
Approach LOS			A	B										
Intersection Summary														
Average Delay				4.8										
Intersection Capacity Utilization	36.0%			ICU Level of Service					A					
Analysis Period (min)				15										

























HCM Signalized Intersection Capacity Analysis
3: Lake Mary Road & Canyon Boulevard

Saturday Peak - Alternative 1
10/12/2010

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	1.00	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1770	1863	1863	1583	3432	
Flt Permitted	0.59	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1097	1863	1863	1583	3432	
Volume (vph)	20	215	250	245	525	15
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	239	278	272	583	17
RTOR Reduction (vph)	0	0	0	118	6	0
Lane Group Flow (vph)	22	239	278	154	594	0
Turn Type	Perm			Perm		
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	24.9	24.9	24.9	24.9	11.4	
Effective Green, g (s)	25.5	25.5	25.5	25.5	11.5	
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.26	
Clearance Time (s)	4.6	4.6	4.6	4.6	4.1	
Vehicle Extension (s)	6.1	6.1	6.1	6.1	2.0	
Lane Grp Cap (vph)	622	1056	1056	897	877	
v/s Ratio Prot		0.13	c0.15		c0.17	
v/s Ratio Perm	0.02			0.10		
v/c Ratio	0.04	0.23	0.26	0.17	0.68	
Uniform Delay, d1	4.3	4.8	5.0	4.7	15.1	
Progression Factor	1.00	1.00	0.42	0.82	1.00	
Incremental Delay, d2	0.1	0.5	0.5	0.3	1.6	
Delay (s)	4.4	5.3	2.6	4.2	16.7	
Level of Service	A	A	A	A	B	
Approach Delay (s)		5.3	3.4		16.7	
Approach LOS		A	A		B	
Intersection Summary						
HCM Average Control Delay		9.4		HCM Level of Service	A	
HCM Volume to Capacity ratio		0.39				
Actuated Cycle Length (s)		45.0		Sum of lost time (s)	8.0	
Intersection Capacity Utilization		38.7%		ICU Level of Service	A	
Analysis Period (min)		15				
c Critical Lane Group						

















HCM Signalized Intersection Capacity Analysis
4: Lake Mary Road & Minaret Road

Saturday Peak - Alternative 1
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.97	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	3433	1672	1672
Flt Permitted	0.36	1.00	1.00	0.30	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	675	3539	1583	550	3539	1583	1770	1863	1583	3433	1672	1672
Volume (vph)	115	460	170	80	350	145	415	320	100	555	65	140
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	128	511	189	89	389	161	461	356	111	617	72	156
RTOR Reduction (vph)	0	0	83	0	0	126	0	0	75	0	86	0
Lane Group Flow (vph)	128	511	106	89	389	35	461	356	36	617	142	0
Turn Type	pm+pt			Perm	pm+pt		Perm	Split		Perm	Split	
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases	2		2	6		6			8			
Actuated Green, G (s)	25.6	19.6	19.6	23.2	18.4	18.4	27.1	27.1	27.1	20.0	20.0	
Effective Green, g (s)	26.6	20.5	20.5	24.2	19.3	19.3	28.0	28.0	28.0	20.6	20.6	
Actuated g/C Ratio	0.30	0.23	0.23	0.27	0.21	0.21	0.31	0.31	0.31	0.23	0.23	
Clearance Time (s)	4.1	4.9	4.9	4.1	4.9	4.9	4.9	4.9	4.9	4.6	4.6	
Vehicle Extension (s)	2.5	4.7	4.7	2.5	4.6	4.6	5.2	5.2	5.2	6.2	6.2	
Lane Grp Cap (vph)	274	806	361	214	759	339	551	580	492	786	383	
v/s Ratio Prot	c0.03	c0.14		0.02	0.11		c0.26	0.19		c0.18	0.08	
v/s Ratio Perm	0.11		0.07	0.09		0.02			0.02			
v/c Ratio	0.47	0.63	0.29	0.42	0.51	0.10	0.84	0.61	0.07	0.78	0.37	
Uniform Delay, d1	24.3	31.4	28.8	25.6	31.2	28.4	28.9	26.4	21.9	32.6	29.2	
Progression Factor	0.83	0.83	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.8	3.2	1.8	1.0	2.5	0.6	14.0	4.8	0.3	7.7	2.7	
Delay (s)	20.9	29.4	26.4	26.6	33.7	29.0	42.9	31.2	22.1	40.4	32.0	
Level of Service	C	C	C	C	C	C	D	C	C	D	C	
Approach Delay (s)		27.4			31.5			35.9			38.1	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM Average Control Delay		33.4		HCM Level of Service	C							
HCM Volume to Capacity ratio		0.71										
Actuated Cycle Length (s)		90.0		Sum of lost time (s)	12.0							
Intersection Capacity Utilization		66.1%		ICU Level of Service	C							
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
5: Main Street & Mountain Boulevard

Saturday Peak - Alternative 1
10/12/2010



















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Sign Control	Free			Free			Stop			Stop			
Grade	0%			0%			0%			0%			
Volume (veh/h)	25	1235	65	30	575	85	10	20	20	55	15	55	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	28	1372	72	33	639	94	11	22	22	61	17	61	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage (veh)													
Upstream signal (ft)													
pX, platoon unblocked													
vC, conflicting volume	733				1444				1919	2264	722	1528	
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	733				1444				1919	2264	722	1528	
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5	
tC, 2 stage (s)													
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5	
p0 queue free %	97				93				50	39	94	0	
cM capacity (veh/h)	867				465				22	36	369	36	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1							
Volume Total	714	758	353	414	56	139							
Volume Left	28	0	33	0	11	61							
Volume Right	0	72	0	94	22	61							
cSH	867	1700	465	1700	47	62							
Volume to Capacity	0.03	0.45	0.07	0.24	1.18	2.25							
Queue Length 95th (ft)	2	0	6	0	128	338							
Control Delay (s)	0.8	0.0	2.3	0.0	327.1	718.6							
Lane LOS	A	A			F	F							
Approach Delay (s)	0.4	1.1			327.1	718.6							
Approach LOS				F			F						
Intersection Summary													
Average Delay				49.1									
Intersection Capacity Utilization	74.7%			ICU Level of Service			D						
Analysis Period (min)	15												

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
6: Main Street & Center Street

Saturday Peak - Alternative 1
10/12/2010




















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	55	805	145	65	545	140	65	35	145	100	0	80
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	61	894	161	72	606	156	72	39	161	111	0	89
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)	1207											
pX, platoon unblocked												
vC, conflicting volume	761				1056				1633	2003	528	1578
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	761				1056				1633	2003	528	1578
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5
tC, 2 stage (s)												
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5
p0 queue free %	93				89				0	20	67	0
cM capacity (veh/h)	847				655				50	49	495	15
											48	617
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	61	596	459	72	404	357	272	200				
Volume Left	61	0	0	72	0	0	72	111				
Volume Right	0	0	161	0	0	156	161	89				
cSH	847	1700	1700	655	1700	1700	106	26				
Volume to Capacity	0.07	0.35	0.27	0.11	0.24	0.21	2.58	7.60				
Queue Length 95th (ft)	6	0	0	9	0	0	623	Err				
Control Delay (s)	9.6	0.0	0.0	11.2	0.0	0.0	802.0	Err				
Lane LOS	A	B			F			F				
Approach Delay (s)	0.5	1.0			802.0			Err				
Approach LOS							F	F				
Intersection Summary												
Average Delay	916.3											
Intersection Capacity Utilization	60.7%			ICU Level of Service					B			
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
Page 6







HCM Unsignalized Intersection Capacity Analysis
7: Main Street & Forest Trail

Saturday Peak - Alternative 1
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	15	985	15	15	605	70	15	0	20	145	5	35
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	17	1094	17	17	672	78	17	0	22	161	6	39
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												1
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)					793							
pX, platoon unblocked												
vC, conflicting volume	750			1111			1508	1919	556	1347	1889	375
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	750			1111			1508	1919	556	1347	1889	375
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			97			76	100	95	0	92	94
cM capacity (veh/h)	855			624			70	63	475	101	66	623
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	17	730	381	17	448	302	39	206				
Volume Left	17	0	0	17	0	0	17	161				
Volume Right	0	0	17	0	0	78	22	39				
cSH	855	1700	1700	624	1700	1700	137	118				
Volume to Capacity	0.02	0.43	0.22	0.03	0.26	0.18	0.28	1.74				
Queue Length 95th (ft)	1	0	0	2	0	0	27	395				
Control Delay (s)	9.3	0.0	0.0	10.9	0.0	0.0	41.3	430.0				
Lane LOS	A			B			E	F				
Approach Delay (s)	0.1			0.2			41.3	430.0				
Approach LOS							E	F				
Intersection Summary												
Average Delay	42.2											
Intersection Capacity Utilization	49.3%			ICU Level of Service						A		
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
8: Main Street & Laurel Mountain Road

Saturday Peak - Alternative 1
10/12/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↱		↱	↑↑	↱	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	915	175	20	595	100	30
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1017	194	22	661	111	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)				505		
pX, platoon unblocked						
vC, conflicting volume			1211		1489	606
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1211		1489	606
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		0	92
cM capacity (veh/h)			572		110	440
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	678	533	22	331	331	144
Volume Left	0	0	22	0	0	111
Volume Right	0	194	0	0	0	33
cSH	1700	1700	572	1700	1700	133
Volume to Capacity	0.40	0.31	0.04	0.19	0.19	1.08
Queue Length 95th (ft)	0	0	3	0	0	202
Control Delay (s)	0.0	0.0	11.6	0.0	0.0	167.0
Lane LOS			B			F
Approach Delay (s)	0.0		0.4			167.0
Approach LOS						F
Intersection Summary						
Average Delay	12.0					
Intersection Capacity Utilization	44.9%		ICU Level of Service			A
Analysis Period (min)	15					

HCM Signalized Intersection Capacity Analysis
9: Main Street & Old Mammoth Road

Saturday Peak - Alternative 1
10/12/2010


























	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↘	↑↑	↘	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	1770	1583
Flt Permitted	1.00	1.00	0.41	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	757	3539	1770	1583
Volume (vph)	340	585	100	255	325	75
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	378	650	111	283	361	83
RTOR Reduction (vph)	0	451	0	0	0	50
Lane Group Flow (vph)	378	199	111	283	361	33
Turn Type	Perm		pm+pt	Perm		
Protected Phases	2	1		6	3	
Permitted Phases	2		6	3		
Actuated Green, G (s)	16.5	16.5	25.1	25.1	22.3	22.3
Effective Green, g (s)	17.4	17.4	26.0	26.0	22.9	22.9
Actuated g/C Ratio	0.31	0.31	0.46	0.46	0.40	0.40
Clearance Time (s)	4.9	4.9	4.1	4.9	4.6	4.6
Vehicle Extension (s)	5.2	5.2	2.5	5.2	5.2	5.2
Lane Grp Cap (vph)	1082	484	428	1617	712	637
v/s Ratio Prot	0.11	c0.02		0.08	c0.20	
v/s Ratio Perm	c0.13		0.10	0.02		
v/c Ratio	0.35	0.41	0.26	0.18	0.51	0.05
Uniform Delay, d1	15.4	15.7	9.2	9.1	12.8	10.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	1.3	0.2	0.1	2.6	0.2
Delay (s)	15.8	16.9	9.4	9.2	15.3	10.5
Level of Service	B	B	A	A	B	B
Approach Delay (s)	16.5			9.3	14.4	
Approach LOS	B			A	B	
Intersection Summary						
HCM Average Control Delay	14.5		HCM Level of Service		B	
HCM Volume to Capacity ratio	0.45					
Actuated Cycle Length (s)	56.9		Sum of lost time (s)		12.0	
Intersection Capacity Utilization	48.4%		ICU Level of Service		A	
Analysis Period (min)	15					
c Critical Lane Group						

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
10: Main Street & Sierra Park Boulevard

Saturday Peak - Alternative 1
10/12/2010


















															
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR			
Lane Configurations		 			 			 			 				
Sign Control		Free			Free			Stop			Stop				
Grade		0%			0%			0%			0%				
Volume (veh/h)	10	350	85	40	290	10	40	10	45	10	10	15			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90			
Hourly flow rate (vph)	11	389	94	44	322	11	44	11	50	11	11	17			
Pedestrians															
Lane Width (ft)															
Walking Speed (ft/s)															
Percent Blockage															
Right turn flare (veh)															
Median type								None			None				
Median storage (veh)															
Upstream signal (ft)		544													
pX, platoon unblocked				0.96			0.96	0.96	0.96	0.96	0.96				
vC, conflicting volume	333			483			731	881	242	689	922	167			
vC1, stage 1 conf vol															
vC2, stage 2 conf vol															
vCu, unblocked vol	333			424			681	837	173	638	880	167			
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9			
tC, 2 stage (s)															
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3			
p0 queue free %	99			96			85	96	94	96	96	98			
cM capacity (veh/h)	1223			1089			295	276	809	304	260	848			
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1							
Volume Total	11	259	224	44	215	119	106	39							
Volume Left	11	0	0	44	0	0	44	11							
Volume Right	0	0	94	0	0	11	50	17							
cSH	1223	1700	1700	1089	1700	1700	418	393							
Volume to Capacity	0.01	0.15	0.13	0.04	0.13	0.07	0.25	0.10							
Queue Length 95th (ft)	1	0	0	3	0	0	25	8							
Control Delay (s)	8.0	0.0	0.0	8.4	0.0	0.0	16.5	15.2							
Lane LOS	A			A			C	C							
Approach Delay (s)	0.2			1.0			16.5	15.2							
Approach LOS							C	C							
Intersection Summary															
Average Delay	2.7														
Intersection Capacity Utilization	34.4%			ICU Level of Service					A						
Analysis Period (min)	15														

LSC, Inc. (BP)
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HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
11: Tavern Road & Old Mammoth Road

Saturday Peak - Alternative 1
10/12/2010

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop		Free				Free	
Grade	0%				0%		0%				0%	
Volume (veh/h)	25	10	45	5	10	25	55	425	10	15	710	45
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	28	11	50	6	11	28	61	472	11	17	789	50
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	760											
pX, platoon unblocked												
vC, conflicting volume	1475	1453	814	1478	1472	478	839	483				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1475	1453	814	1478	1472	478	839	483				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	68	91	87	93	90	95	92	98				
cM capacity (veh/h)	86	118	378	78	115	588	796	1079				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	89	44	61	483	17	839						
Volume Left	28	6	61	0	17	0						
Volume Right	50	28	0	11	0	50						
cSH	162	207	796	1700	1079	1700						
Volume to Capacity	0.55	0.21	0.08	0.28	0.02	0.49						
Queue Length 95th (ft)	70	20	6	0	1	0						
Control Delay (s)	51.5	27.1	9.9	0.0	8.4	0.0						
Lane LOS	F	D	A		A							
Approach Delay (s)	51.5	27.1	1.1		0.2							
Approach LOS	F	D										
Intersection Summary												
Average Delay	4.3											
Intersection Capacity Utilization	61.8%		ICU Level of Service				B					
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
12: Sierra Nevada Road & Old Mammoth Road

Saturday Peak - Alternative 1
10/12/2010

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Sign Control	Stop			Stop			Free			Free			
Grade	0%			0%			0%			0%			
Volume (veh/h)	20	15	85	20	20	30	70	410	5	45	625	45	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	22	17	94	22	22	33	78	456	6	50	694	50	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type	None				None								
Median storage (veh)													
Upstream signal (ft)	773												
pX, platoon unblocked	0.99	0.99		0.99	0.99	0.99				0.99			
vC, conflicting volume	1475	1436	719	1511	1458	458	744						461
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1478	1439	719	1514	1461	455	744						458
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1						4.1
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2						2.2
p0 queue free %	70	85	78	63	80	94	91						95
cM capacity (veh/h)	75	115	428	61	111	601	863						1096
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2							
Volume Total	133	78	78	461	50	744							
Volume Left	22	22	78	0	50	0							
Volume Right	94	33	0	6	0	50							
cSH	201	125	863	1700	1096	1700							
Volume to Capacity	0.66	0.62	0.09	0.27	0.05	0.44							
Queue Length 95th (ft)	100	80	7	0	4	0							
Control Delay (s)	52.5	72.0	9.6	0.0	8.4	0.0							
Lane LOS	F	F	A		A								
Approach Delay (s)	52.5	72.0	1.4		0.5								
Approach LOS	F	F											
Intersection Summary													
Average Delay	8.9												
Intersection Capacity Utilization	57.7%			ICU Level of Service					B				
Analysis Period (min)	15												

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis 13: Meridian Boulevard & Majestic Pines Drive

Saturday Peak - Alternative 1
10/12/2010

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕		↕↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	60	455	225	70	50	40
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	67	506	250	78	56	44
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	328				675	164
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	328				675	164
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				85	95
cM capacity (veh/h)	1229				366	852
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	235	337	167	161	100	
Volume Left	67	0	0	0	56	
Volume Right	0	0	0	78	44	
cSH	1229	1700	1700	1700	491	
Volume to Capacity	0.05	0.20	0.10	0.09	0.20	
Queue Length 95th (ft)	4	0	0	0	19	
Control Delay (s)	2.6	0.0	0.0	0.0	14.2	
Lane LOS	A				B	
Approach Delay (s)	1.1		0.0		14.2	
Approach LOS					B	
Intersection Summary						
Average Delay			2.0			
Intersection Capacity Utilization			38.0%		ICU Level of Service	A
Analysis Period (min)			15			





















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HCM Unsignalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis

14: Meridian Boulevard & Minaret Road

Saturday Peak - Alternative 1
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.94		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3408		1770	3311		1770	1826		1770	1817	
Flt Permitted	0.34	1.00		0.39	1.00		0.28	1.00		0.42	1.00	
Satd. Flow (perm)	629	3408		726	3311		524	1826		777	1817	
Volume (vph)	155	335	110	35	205	155	60	195	30	330	485	95
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	172	372	122	39	228	172	67	217	33	367	539	106
RTOR Reduction (vph)	0	34	0	0	135	0	0	6	0	0	8	0
Lane Group Flow (vph)	172	460	0	39	265	0	67	244	0	367	637	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	24.5	18.7		18.9	15.9		25.9	22.9		41.5	34.4	
Effective Green, g (s)	25.5	19.6		19.9	16.8		26.9	23.8		42.4	35.3	
Actuated g/C Ratio	0.33	0.25		0.26	0.22		0.35	0.31		0.55	0.46	
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9		4.1	4.9	
Vehicle Extension (s)	2.5	5.0		2.5	5.0		2.5	5.0		2.5	5.0	
Lane Grp Cap (vph)	295	866		229	721		233	564		615	832	
v/s Ratio Prot	c0.04	0.13		0.01	0.08		0.01	0.13		c0.11	c0.35	
v/s Ratio Perm	c0.15			0.04			0.09			0.21		
v/c Ratio	0.58	0.53		0.17	0.37		0.29	0.43		0.60	0.77	
Uniform Delay, d1	19.5	24.8		21.8	25.6		17.4	21.3		10.6	17.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.4	1.1		0.3	0.7		0.5	1.1		1.3	5.0	
Delay (s)	21.9	25.9		22.0	26.3		17.9	22.4		11.9	22.5	
Level of Service	C	C		C	C		B	C		B	C	
Approach Delay (s)		24.9			25.9			21.4			18.6	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay			22.0			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			77.1			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			68.9%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis
15: Meridian Boulevard & Old Mammoth Road

Saturday Peak - Alternative 1
10/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flt	1.00	0.98		1.00	0.97		1.00	1.00		0.85	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3457		1770	3444		1770	1863		1583	1770	1863
Flt Permitted	0.34	1.00		0.17	1.00		0.27	1.00		0.47	1.00	1.00
Satd. Flow (perm)	635	3457		321	3444		511	1863		1583	879	1863
Volume (vph)	185	680	125	110	365	80	145	245	55	125	345	60
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	206	756	139	122	406	89	161	272	61	139	383	67
RTOR Reduction (vph)	0	17	0	0	21	0	0	0	42	0	0	47
Lane Group Flow (vph)	206	878	0	122	474	0	161	272	19	139	383	20
Turn Type	pm+pt			pm+pt			pm+pt		Perm	pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	32.4	24.7		27.6	22.3		27.2	21.7	21.7	25.6	20.9	20.9
Effective Green, g (s)	33.4	25.6		28.6	23.2		28.2	22.6	22.6	26.6	21.8	21.8
Actuated g/C Ratio	0.45	0.34		0.38	0.31		0.38	0.30	0.30	0.36	0.29	0.29
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9	4.9	4.1	4.9	4.9
Vehicle Extension (s)	2.5	3.7		2.5	3.8		2.5	3.8	3.8	2.5	3.8	3.8
Lane Grp Cap (vph)	404	1190		229	1074		288	566	481	372	546	464
v/s Ratio Prot	c0.05	c0.25		0.04	0.14		c0.04	0.15		0.02	c0.21	
v/s Ratio Perm	0.18			0.17			0.17		0.01	0.11		0.01
v/c Ratio	0.51	0.74		0.53	0.44		0.56	0.48	0.04	0.37	0.70	0.04
Uniform Delay, d1	13.2	21.4		16.1	20.4		16.8	21.1	18.2	16.8	23.4	18.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	2.5		1.8	0.4		1.9	0.8	0.0	0.5	4.3	0.0
Delay (s)	14.0	24.0		18.0	20.8		18.6	21.9	18.3	17.3	27.7	18.9
Level of Service	B	C		B	C		B	C	B	B	C	B
Approach Delay (s)		22.1			20.2			20.4			24.2	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay		21.9			HCM Level of Service			C				
HCM Volume to Capacity ratio		0.71										
Actuated Cycle Length (s)		74.4			Sum of lost time (s)			16.0				
Intersection Capacity Utilization		68.4%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
16: Meridian Boulevard & Sierra Park Road

Saturday Peak - Alternative 1
10/12/2010


















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	50	160	5	155	15	25	5	5	15	5	80	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	56	178	6	172	17	28	6	6	17	6	89	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total (vph)	144	94	92	103	39	111						
Volume Left (vph)	56	0	6	0	28	17						
Volume Right (vph)	0	6	0	17	6	89						
Hadj (s)	0.23	-0.01	0.06	-0.08	0.09	-0.42						
Departure Headway (s)	5.3	5.1	5.2	5.0	5.1	4.5						
Degree Utilization, x	0.21	0.13	0.13	0.14	0.06	0.14						
Capacity (veh/h)	651	685	665	687	642	729						
Control Delay (s)	8.5	7.6	7.8	7.7	8.4	8.3						
Approach Delay (s)	8.2		7.7		8.4	8.3						
Approach LOS	A		A		A	A						
Intersection Summary												
Delay		8.1										
HCM Level of Service		A										
Intersection Capacity Utilization		27.7%			ICU Level of Service					A		
Analysis Period (min)		15										

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
17: Chateau Road & Old Mammoth Road

Saturday Peak - Alternative 1
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop		Free				Free	
Grade	0%				0%		0%				0%	
Volume (veh/h)	35	35	10	10	20	60	10	325	10	110	395	85
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	39	39	11	11	22	67	11	361	11	122	439	94
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)												1037
pX, platoon unblocked	0.95	0.95	0.95	0.95	0.95		0.95					
vC, conflicting volume	1192	1125	486	1103	1167	367	533	372				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1202	1132	459	1108	1175	367	509	372				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	66	77	98	92	86	90	99	90				
cM capacity (veh/h)	113	171	572	132	161	679	1004	1186				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	89	100	11	372	122	533						
Volume Left	39	11	11	0	122	0						
Volume Right	11	67	0	11	0	94						
cSH	151	312	1004	1700	1186	1700						
Volume to Capacity	0.59	0.32	0.01	0.22	0.10	0.31						
Queue Length 95th (ft)	77	34	1	0	9	0						
Control Delay (s)	58.4	21.9	8.6	0.0	8.4	0.0						
Lane LOS	F	C	A		A							
Approach Delay (s)	58.4	21.9	0.3	1.6								
Approach LOS	F	C										
Intersection Summary												
Average Delay	6.9											
Intersection Capacity Utilization	50.3%		ICU Level of Service				A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
18: Old Mammoth Road & Minaret Road













Saturday Peak - Alternative 1
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	115	165	45	135	190	95	20	65	90	105	155	220
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	128	183	50	150	211	106	22	72	100	117	172	244
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type									None	None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	317			233			1306	1081	208	1089	1053	264
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	317			233			1306	1081	208	1089	1053	264
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	90			89			0	58	88	0	4	68
cM capacity (veh/h)	1243			1334			12	174	832	98	180	775
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	128	233	150	317	194	117	417					
Volume Left	128	0	150	0	22	117	0					
Volume Right	0	50	0	106	100	0	244					
cSH	1243	1700	1334	1700	212	98	328					
Volume to Capacity	0.10	0.14	0.11	0.19	0.92	1.19	1.27					
Queue Length 95th (ft)	9	0	9	0	187	197	481					
Control Delay (s)	8.2	0.0	8.0	0.0	88.7	231.4	177.0					
Lane LOS	A		A		F	F	F					
Approach Delay (s)	2.9	2.6		88.7		188.9						
Approach LOS				F		F						
Intersection Summary												
Average Delay	77.3											
Intersection Capacity Utilization	53.8%			ICU Level of Service					A			
Analysis Period (min)	15											

Future - Alternative 2 LOS Reports













HCM Unsignalized Intersection Capacity Analysis
1: Forest Trail & Minaret Road

Saturday Peak - Alternative 2
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕				↕			↕			↕	
Sign Control	Stop				Stop			Free			Free	
Grade	0%				0%			0%			0%	
Volume (veh/h)	20	35	100	20	20	15	75	190	35	90	730	110
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	39	111	22	22	17	83	211	39	100	811	122
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1497	1489	872	1600	1531	231	933	250				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1497	1489	872	1600	1531	231	933	250				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	68	62	68	38	77	98	89	92				
cM capacity (veh/h)	70	101	350	36	96	809	733	1316				
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	172	61	333	1033								
Volume Left	22	22	83	100								
Volume Right	111	17	39	122								
cSH	169	70	733	1316								
Volume to Capacity	1.02	0.88	0.11	0.08								
Queue Length 95th (ft)	205	107	10	6								
Control Delay (s)	128.8	174.3	3.7	2.0								
Lane LOS	F	F	A	A								
Approach Delay (s)	128.8	174.3	3.7	2.0								
Approach LOS	F	F										
Intersection Summary												
Average Delay	22.6											
Intersection Capacity Utilization	71.3%			ICU Level of Service					C			
Analysis Period (min)	15											













HCM Unsignalized Intersection Capacity Analysis
2: Lake Mary Road & Davidson

Saturday Peak - Alternative 2
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕											
Sign Control	Free				Free				Stop		Stop	
Grade	0%				0%				0%		0%	
Volume (veh/h)	0	95	15	90	95	45	10	0	70	70	0	5
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	106	17	100	106	50	11	0	78	78	0	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type									None		None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	156				122				450	469	114	483
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	156				122				450	469	114	483
tC, single (s)	4.1				4.1				7.1	6.5	6.2	7.1
tC, 2 stage (s)												
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5
p0 queue free %	100				93				98	100	92	82
cM capacity (veh/h)	1425				1465				489	458	939	429
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	122	256	89	83								
Volume Left	0	100	11	78								
Volume Right	17	50	78	6								
cSH	1425	1465	1073	445								
Volume to Capacity	0.00	0.07	0.08	0.19								
Queue Length 95th (ft)	0	5	7	17								
Control Delay (s)	0.0	3.3	9.6	14.9								
Lane LOS		A	A	B								
Approach Delay (s)	0.0	3.3	9.6	14.9								
Approach LOS			A	B								
Intersection Summary												
Average Delay	5.4											
Intersection Capacity Utilization	36.9%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Signalized Intersection Capacity Analysis
3: Lake Mary Road & Canyon Boulevard

Saturday Peak - Alternative 2
10/12/2010

























						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	1.00	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1770	1863	1863	1583	3435	
Flt Permitted	0.60	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1119	1863	1863	1583	3435	
Volume (vph)	20	200	230	240	515	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	222	256	267	572	11
RTOR Reduction (vph)	0	0	0	115	4	0
Lane Group Flow (vph)	22	222	256	152	579	0
Turn Type	Perm			Perm		
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	25.0	25.0	25.0	25.0	11.3	
Effective Green, g (s)	25.6	25.6	25.6	25.6	11.4	
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.25	
Clearance Time (s)	4.6	4.6	4.6	4.6	4.1	
Vehicle Extension (s)	6.1	6.1	6.1	6.1	2.0	
Lane Grp Cap (vph)	637	1060	1060	901	870	
v/s Ratio Prot		0.12	c0.14		c0.17	
v/s Ratio Perm	0.02			0.10		
v/c Ratio	0.03	0.21	0.24	0.17	0.67	
Uniform Delay, d1	4.3	4.7	4.8	4.6	15.1	
Progression Factor	1.00	1.00	0.41	0.81	1.00	
Incremental Delay, d2	0.1	0.4	0.4	0.3	1.5	
Delay (s)	4.4	5.2	2.4	4.1	16.6	
Level of Service	A	A	A	A	B	
Approach Delay (s)		5.1	3.3		16.6	
Approach LOS		A	A		B	
Intersection Summary						
HCM Average Control Delay		9.4		HCM Level of Service	A	
HCM Volume to Capacity ratio		0.37				
Actuated Cycle Length (s)		45.0		Sum of lost time (s)	8.0	
Intersection Capacity Utilization		38.3%		ICU Level of Service	A	
Analysis Period (min)		15				
c Critical Lane Group						

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
Page 3

HCM Signalized Intersection Capacity Analysis
4: Lake Mary Road & Minaret Road

Saturday Peak - Alternative 2
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.97	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	3433	1672	1672
Flt Permitted	0.37	1.00	1.00	0.32	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	696	3539	1583	590	3539	1583	1770	1863	1583	3433	1672	1672
Volume (vph)	115	440	165	80	340	140	400	315	95	535	65	140
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	128	489	183	89	378	156	444	350	106	594	72	156
RTOR Reduction (vph)	0	0	84	0	0	123	0	0	73	0	86	0
Lane Group Flow (vph)	128	489	99	89	378	33	444	350	33	594	142	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases	2		2	6		6			8			
Actuated Green, G (s)	25.6	19.6	19.6	23.2	18.4	18.4	27.1	27.1	27.1	20.0	20.0	
Effective Green, g (s)	26.6	20.5	20.5	24.2	19.3	19.3	28.0	28.0	28.0	20.6	20.6	
Actuated g/C Ratio	0.30	0.23	0.23	0.27	0.21	0.21	0.31	0.31	0.31	0.23	0.23	
Clearance Time (s)	4.1	4.9	4.9	4.1	4.9	4.9	4.9	4.9	4.9	4.6	4.6	
Vehicle Extension (s)	2.5	4.7	4.7	2.5	4.6	4.6	5.2	5.2	5.2	6.2	6.2	
Lane Grp Cap (vph)	279	806	361	223	759	339	551	580	492	786	383	
v/s Ratio Prot	c0.03	c0.14		0.02	0.11		c0.25	0.19		c0.17	0.08	
v/s Ratio Perm	0.10		0.06	0.09		0.02			0.02			
v/c Ratio	0.46	0.61	0.27	0.40	0.50	0.10	0.81	0.60	0.07	0.76	0.37	
Uniform Delay, d1	24.3	31.1	28.6	25.6	31.1	28.4	28.5	26.3	21.8	32.4	29.2	
Progression Factor	0.81	0.82	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	2.9	1.6	0.9	2.3	0.6	11.9	4.6	0.3	6.7	2.7	
Delay (s)	20.5	28.5	26.3	26.4	33.4	29.0	40.4	30.9	22.1	39.0	32.0	
Level of Service	C	C	C	C	C	C	D	C	C	D	C	
Approach Delay (s)		26.7			31.3			34.6			37.1	
Approach LOS		C			C			C			D	
Intersection Summary												
HCM Average Control Delay		32.6		HCM Level of Service	C							
HCM Volume to Capacity ratio		0.68										
Actuated Cycle Length (s)		90.0		Sum of lost time (s)	12.0							
Intersection Capacity Utilization		64.7%		ICU Level of Service	C							
Analysis Period (min)		15										
c Critical Lane Group												

















LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis

5: Main Street & Mountain Boulevard

Saturday Peak - Alternative 2
10/12/2010



















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Free				Free			Stop			Stop	
Grade	0%				0%			0%			0%	
Volume (veh/h)	25	1195	60	25	560	85	10	20	15	55	15	60
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	28	1328	67	28	622	94	11	22	17	61	17	67
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type									None	None		
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	717			1394			1858	2189	697	1472	2175	358
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	717			1394			1858	2189	697	1472	2175	358
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			94			58	46	96	0	60	90
cM capacity (veh/h)	880			486			26	41	383	45	42	638
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	692	731	339	406	50	144						
Volume Left	28	0	28	0	11	61						
Volume Right	0	67	0	94	17	67						
cSH	880	1700	486	1700	50	78						
Volume to Capacity	0.03	0.43	0.06	0.24	1.01	1.85						
Queue Length 95th (ft)	2	0	5	0	109	315						
Control Delay (s)	0.8	0.0	1.9	0.0	261.0	514.4						
Lane LOS	A		A		F	F						
Approach Delay (s)	0.4		0.9		261.0	514.4						
Approach LOS					F	F						
Intersection Summary												
Average Delay			37.5									
Intersection Capacity Utilization			73.1%		ICU Level of Service				D			
Analysis Period (min)			15									

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis 6: Main Street & Center Street

Saturday Peak - Alternative 2
10/12/2010




















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Volume (veh/h)	55	795	140	65	540	140	65	35	140	100	0	80
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	61	883	156	72	600	156	72	39	156	111	0	89
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)	1207											
pX, platoon unblocked												
vC, conflicting volume	756				1039				1617	1983	519	1561
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	756				1039				1617	1983	519	1561
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5
tC, 2 stage (s)												
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5
p0 queue free %	93				89				0	22	69	0
cM capacity (veh/h)	851				665				51	50	501	17
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	61	589	450	72	400	356	267	200				
Volume Left	61	0	0	72	0	0	72	111				
Volume Right	0	0	156	0	0	156	156	89				
cSH	851	1700	1700	665	1700	1700	107	30				
Volume to Capacity	0.07	0.35	0.26	0.11	0.24	0.21	2.50	6.75				
Queue Length 95th (ft)	6	0	0	9	0	0	603	Err				
Control Delay (s)	9.6	0.0	0.0	11.1	0.0	0.0	764.2	Err				
Lane LOS	A				B				F	F		
Approach Delay (s)	0.5				1.0				764.2	Err		
Approach LOS							F		F			
Intersection Summary												
Average Delay	920.9											
Intersection Capacity Utilization	60.0%			ICU Level of Service					B			
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
Page 6







HCM Unsignalized Intersection Capacity Analysis
7: Main Street & Forest Trail

Saturday Peak - Alternative 2
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	15	970	15	15	595	70	15	0	20	145	5	35
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	17	1078	17	17	661	78	17	0	22	161	6	39
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												1
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)					793							
pX, platoon unblocked												
vC, conflicting volume	739			1094			1486	1892	547	1328	1861	369
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	739			1094			1486	1892	547	1328	1861	369
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			97			77	100	95	0	92	94
cM capacity (veh/h)	863			633			73	66	481	104	69	628
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	17	719	376	17	441	298	39	206				
Volume Left	17	0	0	17	0	0	17	161				
Volume Right	0	0	17	0	0	78	22	39				
cSH	863	1700	1700	633	1700	1700	142	122				
Volume to Capacity	0.02	0.42	0.22	0.03	0.26	0.18	0.27	1.68				
Queue Length 95th (ft)	1	0	0	2	0	0	26	386				
Control Delay (s)	9.3	0.0	0.0	10.8	0.0	0.0	39.6	402.9				
Lane LOS	A			B			E	F				
Approach Delay (s)	0.1			0.2			39.6	402.9				
Approach LOS							E	F				
Intersection Summary												
Average Delay	40.1											
Intersection Capacity Utilization	48.9%			ICU Level of Service						A		
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
8: Main Street & Laurel Mountain Road

Saturday Peak - Alternative 2
10/12/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↱		↱	↑↑	↱	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	940	140	15	610	80	25
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1044	156	17	678	89	28
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)				505		
pX, platoon unblocked						
vC, conflicting volume			1200		1494	600
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1200		1494	600
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		20	94
cM capacity (veh/h)			577		110	444
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	696	504	17	339	339	117
Volume Left	0	0	17	0	0	89
Volume Right	0	156	0	0	0	28
cSH	1700	1700	577	1700	1700	135
Volume to Capacity	0.41	0.30	0.03	0.20	0.20	0.87
Queue Length 95th (ft)	0	0	2	0	0	140
Control Delay (s)	0.0	0.0	11.4	0.0	0.0	108.4
Lane LOS			B			F
Approach Delay (s)	0.0		0.3			108.4
Approach LOS						F
Intersection Summary						
Average Delay	6.4					
Intersection Capacity Utilization	43.1%		ICU Level of Service			A
Analysis Period (min)	15					

HCM Signalized Intersection Capacity Analysis
9: Main Street & Old Mammoth Road

Saturday Peak - Alternative 2
10/12/2010

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	1770	1583
Flt Permitted	1.00	1.00	0.39	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	719	3539	1770	1583
Volume (vph)	365	510	85	270	280	65
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	406	567	94	300	311	72
RTOR Reduction (vph)	0	393	0	0	0	43
Lane Group Flow (vph)	406	174	94	300	311	29
Turn Type	Perm		pm+pt		Perm	
Protected Phases	2		1	6	3	
Permitted Phases		2	6			3
Actuated Green, G (s)	16.6	16.6	25.2	25.2	22.4	22.4
Effective Green, g (s)	17.5	17.5	26.1	26.1	23.0	23.0
Actuated g/C Ratio	0.31	0.31	0.46	0.46	0.40	0.40
Clearance Time (s)	4.9	4.9	4.1	4.9	4.6	4.6
Vehicle Extension (s)	5.2	5.2	2.5	5.2	5.2	5.2
Lane Grp Cap (vph)	1085	485	413	1618	713	638
v/s Ratio Prot	c0.11		c0.02	0.08	c0.18	
v/s Ratio Perm		0.11	0.09			0.02
v/c Ratio	0.37	0.36	0.23	0.19	0.44	0.05
Uniform Delay, d1	15.5	15.4	9.2	9.2	12.4	10.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.0	0.2	0.1	1.9	0.1
Delay (s)	16.0	16.4	9.4	9.3	14.3	10.5
Level of Service	B	B	A	A	B	B
Approach Delay (s)	16.3			9.3	13.6	
Approach LOS	B			A	B	
Intersection Summary						
HCM Average Control Delay		14.1		HCM Level of Service		B
HCM Volume to Capacity ratio		0.39				
Actuated Cycle Length (s)		57.1		Sum of lost time (s)		12.0
Intersection Capacity Utilization		43.2%		ICU Level of Service		A
Analysis Period (min)		15				
c Critical Lane Group						

























HCM Unsignalized Intersection Capacity Analysis
10: Main Street & Sierra Park Boulevard

Saturday Peak - Alternative 2
10/12/2010

	↖	→	↘	↙	←	↖	↗	↑	↘	↙	↓	↖
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↕↕		↖	↕↕			↕↕			↕↕	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	10	355	85	40	295	10	40	10	45	10	10	15
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	394	94	44	328	11	44	11	50	11	11	17
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)		544										
pX, platoon unblocked				0.95			0.95	0.95	0.95	0.95	0.95	
vC, conflicting volume	339			489			739	892	244	697	933	169
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	339			412			675	835	155	631	879	169
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			96			85	96	94	96	96	98
cM capacity (veh/h)	1217			1088			295	273	821	305	257	845
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	11	263	226	44	219	120	106	39				
Volume Left	11	0	0	44	0	0	44	11				
Volume Right	0	0	94	0	0	11	50	17				
cSH	1217	1700	1700	1088	1700	1700	419	391				
Volume to Capacity	0.01	0.15	0.13	0.04	0.13	0.07	0.25	0.10				
Queue Length 95th (ft)	1	0	0	3	0	0	25	8				
Control Delay (s)	8.0	0.0	0.0	8.4	0.0	0.0	16.5	15.2				
Lane LOS	A			A			C	C				
Approach Delay (s)	0.2			1.0			16.5	15.2				
Approach LOS							C	C				
Intersection Summary												
Average Delay	2.7											
Intersection Capacity Utilization	34.5%		ICU Level of Service		A							
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
11: Tavern Road & Old Mammoth Road

Saturday Peak - Alternative 2
10/12/2010

















																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR								
Lane Configurations																				
Sign Control	Stop			Stop			Free			Free										
Grade	0%			0%			0%			0%										
Volume (veh/h)	10	5	25	5	5	15	30	390	5	10	660	25								
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90								
Hourly flow rate (vph)	11	6	28	6	6	17	33	433	6	11	733	28								
Pedestrians																				
Lane Width (ft)																				
Walking Speed (ft/s)																				
Percent Blockage																				
Right turn flare (veh)																				
Median type	None			None																
Median storage (veh)																				
Upstream signal (ft)	760																			
pX, platoon unblocked																				
vC, conflicting volume	1289	1275	747	1289	1286	436	761	439												
vC1, stage 1 conf vol																				
vC2, stage 2 conf vol																				
vCu, unblocked vol	1289	1275	747	1289	1286	436	761	439												
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1												
tC, 2 stage (s)																				
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2												
p0 queue free %	91	97	93	95	96	97	96	99												
cM capacity (veh/h)	128	159	413	123	156	620	851	1121												
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2														
Volume Total	44	28	33	439	11	761														
Volume Left	11	6	33	0	11	0														
Volume Right	28	17	0	6	0	28														
cSH	235	258	851	1700	1121	1700														
Volume to Capacity	0.19	0.11	0.04	0.26	0.01	0.45														
Queue Length 95th (ft)	17	9	3	0	1	0														
Control Delay (s)	23.8	20.6	9.4	0.0	8.2	0.0														
Lane LOS	C	C	A		A															
Approach Delay (s)	23.8	20.6	0.7		0.1															
Approach LOS	C	C																		
Intersection Summary																				
Average Delay	1.5																			
Intersection Capacity Utilization	46.3%			ICU Level of Service				A												
Analysis Period (min)	15																			

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
12: Sierra Nevada Road & Old Mammoth Road

Saturday Peak - Alternative 2
10/12/2010










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	20	15	80	20	20	30	70	390	5	45	590	45
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	17	89	22	22	33	78	433	6	50	656	50
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	773											
pX, platoon unblocked												
vC, conflicting volume	1414	1375	681	1444	1397	436	706				439	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1414	1375	681	1444	1397	436	706				439	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	74	87	80	69	82	95	91				96	
cM capacity (veh/h)	85	127	451	72	123	620	893				1121	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	128	78	78	439	50	706						
Volume Left	22	22	78	0	50	0						
Volume Right	89	33	0	6	0	50						
cSH	216	143	893	1700	1121	1700						
Volume to Capacity	0.59	0.54	0.09	0.26	0.04	0.42						
Queue Length 95th (ft)	83	67	7	0	3	0						
Control Delay (s)	43.1	56.9	9.4	0.0	8.4	0.0						
Lane LOS	E	F	A		A							
Approach Delay (s)	43.1	56.9	1.4		0.6							
Approach LOS	E	F										
Intersection Summary												
Average Delay	7.5											
Intersection Capacity Utilization	55.6%			ICU Level of Service				B				
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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








HCM Unsignalized Intersection Capacity Analysis
13: Meridian Boulevard & Majestic Pines Drive

Saturday Peak - Alternative 2
10/12/2010

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	60	435	220	70	50	40
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	67	483	244	78	56	44
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	322				658	161
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	322				658	161
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				85	95
cM capacity (veh/h)	1234				376	855
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	228	322	163	159	100	
Volume Left	67	0	0	0	56	
Volume Right	0	0	0	78	44	
cSH	1234	1700	1700	1700	500	
Volume to Capacity	0.05	0.19	0.10	0.09	0.20	
Queue Length 95th (ft)	4	0	0	0	18	
Control Delay (s)	2.7	0.0	0.0	0.0	14.0	
Lane LOS	A				B	
Approach Delay (s)	1.1		0.0		14.0	
Approach LOS					B	
Intersection Summary						
Average Delay	2.1					
Intersection Capacity Utilization	37.3%		ICU Level of Service		A	
Analysis Period (min)	15					

HCM Signalized Intersection Capacity Analysis
14: Meridian Boulevard & Minaret Road

Saturday Peak - Alternative 2
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.93		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3413		1770	3304		1770	1831		1770	1817	
Flt Permitted	0.35	1.00		0.42	1.00		0.33	1.00		0.41	1.00	
Satd. Flow (perm)	647	3413		781	3304		619	1831		770	1817	
Volume (vph)	140	320	100	35	195	155	55	200	25	330	455	90
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	156	356	111	39	217	172	61	222	28	367	506	100
RTOR Reduction (vph)	0	32	0	0	135	0	0	5	0	0	8	0
Lane Group Flow (vph)	156	435	0	39	254	0	61	245	0	367	598	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	24.2	18.4		18.6	15.6		25.2	22.2		40.9	33.8	
Effective Green, g (s)	25.2	19.3		19.6	16.5		26.2	23.1		41.8	34.7	
Actuated g/C Ratio	0.33	0.25		0.26	0.22		0.34	0.30		0.55	0.46	
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9		4.1	4.9	
Vehicle Extension (s)	2.5	5.0		2.5	5.0		2.5	5.0		2.5	5.0	
Lane Grp Cap (vph)	301	864		241	715		260	555		615	827	
v/s Ratio Prot	c0.04	0.13		0.01	0.08		0.01	0.13		c0.12	c0.33	
v/s Ratio Perm	c0.13			0.04			0.07			0.21		
v/c Ratio	0.52	0.50		0.16	0.36		0.23	0.44		0.60	0.72	
Uniform Delay, d1	19.0	24.3		21.5	25.3		17.2	21.4		10.5	16.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	1.0		0.2	0.6		0.3	1.2		1.3	3.9	
Delay (s)	20.2	25.3		21.8	26.0		17.5	22.5		11.8	20.7	
Level of Service	C	C		C	C		B	C		B	C	
Approach Delay (s)	24.0			25.6			21.6			17.4		
Approach LOS	C			C			C			B		
Intersection Summary												
HCM Average Control Delay	21.2		HCM Level of Service		C							
HCM Volume to Capacity ratio	0.68											
Actuated Cycle Length (s)	76.2		Sum of lost time (s)		16.0							
Intersection Capacity Utilization	65.9%		ICU Level of Service		C							
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
15: Meridian Boulevard & Old Mammoth Road

Saturday Peak - Alternative 2
10/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3457		1770	3439		1770	1863	1583	1770	1863	1583
Flt Permitted	0.34	1.00		0.17	1.00		0.27	1.00	1.00	0.42	1.00	1.00
Satd. Flow (perm)	626	3457		320	3439		495	1863	1583	783	1863	1583
Volume (vph)	185	685	125	105	365	85	140	275	55	130	350	65
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	206	761	139	117	406	94	156	306	61	144	389	72
RTOR Reduction (vph)	0	17	0	0	22	0	0	0	42	0	0	51
Lane Group Flow (vph)	206	883	0	117	478	0	156	306	19	144	389	21
Turn Type	pm+pt			pm+pt			pm+pt		Perm	pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	32.7	24.9		27.7	22.4		27.3	21.8	21.8	25.7	21.0	21.0
Effective Green, g (s)	33.7	25.8		28.7	23.3		28.3	22.7	22.7	26.7	21.9	21.9
Actuated g/C Ratio	0.45	0.35		0.38	0.31		0.38	0.30	0.30	0.36	0.29	0.29
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9	4.9	4.1	4.9	4.9
Vehicle Extension (s)	2.5	3.7		2.5	3.8		2.5	3.8	3.8	2.5	3.8	3.8
Lane Grp Cap (vph)	403	1194		228	1073		283	566	481	343	546	464
v/s Ratio Prot	c0.05	c0.26		0.04	0.14		c0.04	0.16		0.03	c0.21	
v/s Ratio Perm	0.18			0.16			0.17		0.01	0.12		0.01
v/c Ratio	0.51	0.74		0.51	0.45		0.55	0.54	0.04	0.42	0.71	0.05
Uniform Delay, d1	13.2	21.5		16.2	20.5		16.8	21.7	18.3	17.1	23.6	18.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	2.6		1.5	0.4		1.9	1.3	0.0	0.6	4.6	0.1
Delay (s)	14.0	24.1		17.6	20.9		18.7	22.9	18.4	17.7	28.2	19.0
Level of Service	B	C		B	C		B	C	B	B	C	B
Approach Delay (s)		22.2			20.3			21.1			24.6	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay		22.1			HCM Level of Service			C				
HCM Volume to Capacity ratio		0.71										
Actuated Cycle Length (s)		74.7			Sum of lost time (s)			16.0				
Intersection Capacity Utilization		68.2%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												


















HCM Unsignalized Intersection Capacity Analysis
16: Meridian Boulevard & Sierra Park Road

Saturday Peak - Alternative 2
10/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	50	150	5	5	145	15	25	5	5	15	5	75
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	56	167	6	6	161	17	28	6	6	17	6	83
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total (vph)	139	89	86	97	39	106						
Volume Left (vph)	56	0	6	0	28	17						
Volume Right (vph)	0	6	0	17	6	83						
Hadj (s)	0.23	-0.01	0.07	-0.09	0.09	-0.41						
Departure Headway (s)	5.3	5.0	5.1	5.0	5.1	4.5						
Degree Utilization, x	0.20	0.12	0.12	0.13	0.05	0.13						
Capacity (veh/h)	664	690	669	692	653	737						
Control Delay (s)	8.4	7.5	7.7	7.6	8.4	8.2						
Approach Delay (s)	8.1		7.6		8.4	8.2						
Approach LOS	A		A		A	A						
Intersection Summary												
Delay		8.0										
HCM Level of Service		A										
Intersection Capacity Utilization		26.9%			ICU Level of Service			A				
Analysis Period (min)		15										

HCM Unsignalized Intersection Capacity Analysis
17: Chateau Road & Old Mammoth Road

Saturday Peak - Alternative 2
10/12/2010





















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free				Free	
Grade	0%			0%			0%				0%	
Volume (veh/h)	30	30	10	10	20	55	10	285	10	95	345	70
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	33	33	11	11	22	61	11	317	11	106	383	78
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	1037											
pX, platoon unblocked												
vC, conflicting volume	1044	983	422	967	1017	322	461	328				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1044	983	422	967	1017	322	461	328				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	79	85	98	94	90	91	99	91				
cM capacity (veh/h)	162	225	631	189	215	719	1100	1232				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	78	94	11	328	106	461						
Volume Left	33	11	11	0	106	0						
Volume Right	11	61	0	11	0	78						
cSH	209	382	1100	1700	1232	1700						
Volume to Capacity	0.37	0.25	0.01	0.19	0.09	0.27						
Queue Length 95th (ft)	40	24	1	0	7	0						
Control Delay (s)	32.0	17.5	8.3	0.0	8.2	0.0						
Lane LOS	D	C	A		A							
Approach Delay (s)	32.0	17.5	0.3	1.5								
Approach LOS	D	C										
Intersection Summary												
Average Delay	4.7											
Intersection Capacity Utilization	45.8%			ICU Level of Service				A				
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
18: Old Mammoth Road & Minaret Road

Saturday Peak - Alternative 2
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	105	160	40	125	180	90	20	65	85	95	145	195
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	117	178	44	139	200	100	22	72	94	106	161	217
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)	2											
Median type	NoneNone											
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	300			222			1208	1011	200	1022	983	250
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	300			222			1208	1011	200	1022	983	250
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	91			90			36	63	89	10	20	73
cM capacity (veh/h)	1261			1347			35	195	841	117	202	789
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	117	222	139	300	189	106	378					
Volume Left	117	0	139	0	22	106	0					
Volume Right	0	44	0	100	94	0	217					
cSH	1261	1700	1347	1700	266	117	353					
Volume to Capacity	0.09	0.13	0.10	0.18	0.71	0.90	1.07					
Queue Length 95th (ft)	8	0	9	0	122	140	339					
Control Delay (s)	8.1	0.0	8.0	0.0	46.0	126.9	103.0					
Lane LOS	A		A		E	F	F					
Approach Delay (s)	2.8	2.5		46.0		108.3						
Approach LOS				E		F						
Intersection Summary												
Average Delay	43.5											
Intersection Capacity Utilization	51.6%		ICU Level of Service				A					
Analysis Period (min)	15											













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Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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Future - Alternative 3 LOS Reports














HCM Unsignalized Intersection Capacity Analysis
1: Forest Trail & Minaret Road

Saturday Peak - Alternative 3
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕				↕			↕			↕	
Sign Control	Stop				Stop			Free			Free	
Grade	0%				0%			0%			0%	
Volume (veh/h)	20	35	100	20	20	15	75	190	35	90	735	110
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	39	111	22	22	17	83	211	39	100	817	122
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1503	1494	878	1606	1536	231	939			250		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1503	1494	878	1606	1536	231	939			250		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	68	61	68	37	77	98	89			92		
cM capacity (veh/h)	69	101	347	35	95	809	730			1316		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	172	61	333	1039								
Volume Left	22	22	83	100								
Volume Right	111	17	39	122								
cSH	168	69	730	1316								
Volume to Capacity	1.03	0.89	0.11	0.08								
Queue Length 95th (ft)	208	108	10	6								
Control Delay (s)	132.1	179.2	3.7	2.0								
Lane LOS	F	F	A	A								
Approach Delay (s)	132.1	179.2	3.7	2.0								
Approach LOS	F	F										
Intersection Summary												
Average Delay			23.0									
Intersection Capacity Utilization			71.5%		ICU Level of Service				C			
Analysis Period (min)			15									













HCM Unsignalized Intersection Capacity Analysis
2: Lake Mary Road & Davidson

Saturday Peak - Alternative 3
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Free				Free				Stop		Stop	
Grade	0%				0%				0%		0%	
Volume (veh/h)	0	100	15	85	100	45	10	0	70	65	0	5
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	111	17	94	111	50	11	0	78	72	0	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type									None		None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	161				128				450	469	119	483
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	161				128				450	469	119	483
tC, single (s)	4.1				4.1				7.1	6.5	6.2	7.1
tC, 2 stage (s)												
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5
p0 queue free %	100				94				98	100	92	83
cM capacity (veh/h)	1418				1458				491	460	932	430
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	128	256	89	78								
Volume Left	0	94	11	72								
Volume Right	17	50	78	6								
cSH	1418	1458	1065	447								
Volume to Capacity	0.00	0.06	0.08	0.17								
Queue Length 95th (ft)	0	5	7	16								
Control Delay (s)	0.0	3.2	9.6	14.7								
Lane LOS		A	A	B								
Approach Delay (s)	0.0	3.2	9.6	14.7								
Approach LOS			A	B								
Intersection Summary												
Average Delay	5.1											
Intersection Capacity Utilization	36.6%			ICU Level of Service					A			
Analysis Period (min)	15											

























HCM Signalized Intersection Capacity Analysis
3: Lake Mary Road & Canyon Boulevard

Saturday Peak - Alternative 3
10/12/2010

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	1.00	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1770	1863	1863	1583	3431	
Flt Permitted	0.59	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1108	1863	1863	1583	3431	
Volume (vph)	20	210	240	240	505	15
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	233	267	267	561	17
RTOR Reduction (vph)	0	0	0	115	6	0
Lane Group Flow (vph)	22	233	267	152	572	0
Turn Type	Perm			Perm		
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	25.0	25.0	25.0	25.0	11.3	
Effective Green, g (s)	25.6	25.6	25.6	25.6	11.4	
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.25	
Clearance Time (s)	4.6	4.6	4.6	4.6	4.1	
Vehicle Extension (s)	6.1	6.1	6.1	6.1	2.0	
Lane Grp Cap (vph)	630	1060	1060	901	869	
v/s Ratio Prot		0.13	c0.14		c0.17	
v/s Ratio Perm	0.02			0.10		
v/c Ratio	0.03	0.22	0.25	0.17	0.66	
Uniform Delay, d1	4.3	4.8	4.9	4.6	15.1	
Progression Factor	1.00	1.00	0.43	0.83	1.00	
Incremental Delay, d2	0.1	0.5	0.4	0.3	1.4	
Delay (s)	4.4	5.3	2.5	4.2	16.4	
Level of Service	A	A	A	A	B	
Approach Delay (s)		5.2	3.3		16.4	
Approach LOS		A	A		B	
Intersection Summary						
HCM Average Control Delay		9.2		HCM Level of Service	A	
HCM Volume to Capacity ratio		0.38				
Actuated Cycle Length (s)		45.0		Sum of lost time (s)	8.0	
Intersection Capacity Utilization		38.2%		ICU Level of Service	A	
Analysis Period (min)		15				
c Critical Lane Group						

















HCM Signalized Intersection Capacity Analysis
4: Lake Mary Road & Minaret Road

Saturday Peak - Alternative 3
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.97	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90	0.90
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	3433	1672	1672
Flt Permitted	0.37	1.00	1.00	0.31	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	686	3539	1583	581	3539	1583	1770	1863	1583	3433	1672	1672
Volume (vph)	115	445	160	80	345	145	395	315	95	545	65	140
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	128	494	178	89	383	161	439	350	106	606	72	156
RTOR Reduction (vph)	0	0	81	0	0	126	0	0	73	0	86	0
Lane Group Flow (vph)	128	494	97	89	383	35	439	350	33	606	142	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases	2		2	6		6			8			
Actuated Green, G (s)	25.6	19.6	19.6	23.2	18.4	18.4	27.1	27.1	27.1	20.0	20.0	
Effective Green, g (s)	26.6	20.5	20.5	24.2	19.3	19.3	28.0	28.0	28.0	20.6	20.6	
Actuated g/C Ratio	0.30	0.23	0.23	0.27	0.21	0.21	0.31	0.31	0.31	0.23	0.23	
Clearance Time (s)	4.1	4.9	4.9	4.1	4.9	4.9	4.9	4.9	4.9	4.6	4.6	
Vehicle Extension (s)	2.5	4.7	4.7	2.5	4.6	4.6	5.2	5.2	5.2	6.2	6.2	
Lane Grp Cap (vph)	276	806	361	221	759	339	551	580	492	786	383	
v/s Ratio Prot	c0.03	c0.14		0.02	0.11		c0.25	0.19		c0.18	0.08	
v/s Ratio Perm	0.11		0.06	0.09		0.02			0.02			
v/c Ratio	0.46	0.61	0.27	0.40	0.50	0.10	0.80	0.60	0.07	0.77	0.37	
Uniform Delay, d1	24.3	31.2	28.6	25.6	31.1	28.4	28.4	26.3	21.8	32.5	29.2	
Progression Factor	0.82	0.83	0.87	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.8	3.0	1.6	0.9	2.4	0.6	11.4	4.6	0.3	7.2	2.7	
Delay (s)	20.8	28.9	26.4	26.5	33.5	29.0	39.8	30.9	22.1	39.7	32.0	
Level of Service	C	C	C	C	C	C	D	C	C	D	C	
Approach Delay (s)		27.1			31.4			34.2			37.6	
Approach LOS		C			C			C			D	
Intersection Summary												
HCM Average Control Delay		32.7		HCM Level of Service	C							
HCM Volume to Capacity ratio		0.69										
Actuated Cycle Length (s)		90.0		Sum of lost time (s)	12.0							
Intersection Capacity Utilization		64.5%		ICU Level of Service	C							
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
5: Main Street & Mountain Boulevard

Saturday Peak - Alternative 3
10/12/2010



















																						
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR										
Lane Configurations																						
Sign Control	Free			Free			Stop			Stop												
Grade	0%			0%			0%			0%												
Volume (veh/h)	25	1215	65	25	570	85	10	25	20	60	15	60										
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90										
Hourly flow rate (vph)	28	1350	72	28	633	94	11	28	22	67	17	67										
Pedestrians																						
Lane Width (ft)																						
Walking Speed (ft/s)																						
Percent Blockage																						
Right turn flare (veh)																						
Median type							None			None												
Median storage (veh)																						
Upstream signal (ft)																						
pX, platoon unblocked																						
vC, conflicting volume	728				1422				1889	2225	711	1503	2214	364								
vC1, stage 1 conf vol																						
vC2, stage 2 conf vol																						
vCu, unblocked vol	728				1422				1889	2225	711	1503	2214	364								
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5	6.5	6.9								
tC, 2 stage (s)																						
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5	4.0	3.3								
p0 queue free %	97				94				54	29	94	0	58	89								
cM capacity (veh/h)	872				475				24	39	375	31	39	633								
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1																
Volume Total	703	747	344	411	61	150																
Volume Left	28	0	28	0	11	67																
Volume Right	0	72	0	94	22	67																
cSH	872	1700	475	1700	49	56																
Volume to Capacity	0.03	0.44	0.06	0.24	1.23	2.67																
Queue Length 95th (ft)	2	0	5	0	139	384																
Control Delay (s)	0.8	0.0	1.9	0.0	338.3	910.4																
Lane LOS	A	A		F		F																
Approach Delay (s)	0.4	0.9		338.3		910.4																
Approach LOS			F		F																	
Intersection Summary																						
Average Delay	65.6																					
Intersection Capacity Utilization	74.7%				ICU Level of Service				D													
Analysis Period (min)	15																					

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
6: Main Street & Center Street

Saturday Peak - Alternative 3
10/12/2010




















																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR								
Lane Configurations																				
Sign Control	Free			Free			Stop			Stop										
Grade	0%			0%			0%			0%										
Volume (veh/h)	70	940	95	40	635	55	40	10	90	40	0	35								
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90								
Hourly flow rate (vph)	78	1044	106	44	706	61	44	11	100	44	0	39								
Pedestrians																				
Lane Width (ft)																				
Walking Speed (ft/s)																				
Percent Blockage																				
Right turn flare (veh)																				
Median type							None			None										
Median storage (veh)																				
Upstream signal (ft)	1207																			
pX, platoon unblocked																				
vC, conflicting volume	767				1150				1733	2108	575	1608	2131	383						
vC1, stage 1 conf vol																				
vC2, stage 2 conf vol																				
vCu, unblocked vol	767				1150				1733	2108	575	1608	2131	383						
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5	6.5	6.9						
tC, 2 stage (s)																				
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5	4.0	3.3						
p0 queue free %	91				93				4	74	78	0	100	94						
cM capacity (veh/h)	843				603				46	43	461	39	41	615						
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1												
Volume Total	78	696	454	44	470	296	156	83												
Volume Left	78	0	0	44	0	0	44	44												
Volume Right	0	0	106	0	0	61	100	39												
cSH	843	1700	1700	603	1700	1700	108	69												
Volume to Capacity	0.09	0.41	0.27	0.07	0.28	0.17	1.44	1.21												
Queue Length 95th (ft)	8	0	0	6	0	0	279	165												
Control Delay (s)	9.7	0.0	0.0	11.4	0.0	0.0	313.9	282.0												
Lane LOS	A			B			F	F												
Approach Delay (s)	0.6			0.6			313.9	282.0												
Approach LOS							F	F												
Intersection Summary																				
Average Delay	32.3																			
Intersection Capacity Utilization	51.1%				ICU Level of Service				A											
Analysis Period (min)	15																			

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
Page 6

HCM Unsignalized Intersection Capacity Analysis
7: Main Street & Forest Trail

Saturday Peak - Alternative 3
10/12/2010







												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	20	1055	15	15	650	65	15	0	20	130	5	35
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	1172	17	17	722	72	17	0	22	144	6	39
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												1
Median type								None	None			
Median storage (veh)												
Upstream signal (ft)	793											
pX, platoon unblocked												
vC, conflicting volume	794			1189			1622	2053	594	1444	2025	397
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	794			1189			1622	2053	594	1444	2025	397
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			97			70	100	95	0	90	94
cM capacity (veh/h)	823			583			56	52	448	84	54	602
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	22	781	407	17	481	313	39	189				
Volume Left	22	0	0	17	0	0	17	144				
Volume Right	0	0	17	0	0	72	22	39				
cSH	823	1700	1700	583	1700	1700	113	101				
Volume to Capacity	0.03	0.46	0.24	0.03	0.28	0.18	0.35	1.88				
Queue Length 95th (ft)	2	0	0	2	0	0	34	389				
Control Delay (s)	9.5	0.0	0.0	11.4	0.0	0.0	52.9	500.1				
Lane LOS	A			B			F	F				
Approach Delay (s)	0.2			0.2			52.9	500.1				
Approach LOS							F	F				
Intersection Summary												
Average Delay	43.1											
Intersection Capacity Utilization	50.4%			ICU Level of Service					A			
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
8: Main Street & Laurel Mountain Road

Saturday Peak - Alternative 3
10/12/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↓		↱	↑↑	↲	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	945	150	15	615	85	25
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1050	167	17	683	94	28
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)	505					
pX, platoon unblocked						
vC, conflicting volume			1217		1508	608
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1217		1508	608
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		13	94
cM capacity (veh/h)			569		108	439
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	700	517	17	342	342	122
Volume Left	0	0	17	0	0	94
Volume Right	0	167	0	0	0	28
cSH	1700	1700	569	1700	1700	130
Volume to Capacity	0.41	0.30	0.03	0.20	0.20	0.94
Queue Length 95th (ft)	0	0	2	0	0	157
Control Delay (s)	0.0	0.0	11.5	0.0	0.0	127.2
Lane LOS			B			F
Approach Delay (s)	0.0		0.3			127.2
Approach LOS						F
Intersection Summary						
Average Delay	7.7					
Intersection Capacity Utilization	43.8%		ICU Level of Service			A
Analysis Period (min)	15					

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis
9: Main Street & Old Mammoth Road

Saturday Peak - Alternative 3
10/12/2010























	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↘	↑↑	↘	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	1770	1583
Flt Permitted	1.00	1.00	0.39	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	728	3539	1770	1583
Volume (vph)	360	490	85	265	270	65
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	400	544	94	294	300	72
RTOR Reduction (vph)	0	377	0	0	0	43
Lane Group Flow (vph)	400	167	94	294	300	29
Turn Type	Perm		pm+pt	Perm		
Protected Phases	2	1		6	3	
Permitted Phases	2		6	3		
Actuated Green, G (s)	16.6	16.6	25.2	25.2	22.3	22.3
Effective Green, g (s)	17.5	17.5	26.1	26.1	22.9	22.9
Actuated g/C Ratio	0.31	0.31	0.46	0.46	0.40	0.40
Clearance Time (s)	4.9	4.9	4.1	4.9	4.6	4.6
Vehicle Extension (s)	5.2	5.2	2.5	5.2	5.2	5.2
Lane Grp Cap (vph)	1087	486	417	1620	711	636
v/s Ratio Prot	c0.11	c0.02		0.08	c0.17	
v/s Ratio Perm	0.11		0.08	0.02		
v/c Ratio	0.37	0.34	0.23	0.18	0.42	0.05
Uniform Delay, d1	15.4	15.3	9.1	9.1	12.3	10.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.0	0.2	0.1	1.8	0.1
Delay (s)	15.9	16.3	9.3	9.3	14.1	10.5
Level of Service	B	B	A	A	B	B
Approach Delay (s)	16.1			9.3	13.4	
Approach LOS	B			A	B	
Intersection Summary						
HCM Average Control Delay			14.0	HCM Level of Service		B
HCM Volume to Capacity ratio			0.38			
Actuated Cycle Length (s)			57.0	Sum of lost time (s)		12.0
Intersection Capacity Utilization			42.0%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
10: Main Street & Sierra Park Boulevard

Saturday Peak - Alternative 3
10/12/2010

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	10	350	85	40	290	10	40	10	45	10	10	15
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	389	94	44	322	11	44	11	50	11	11	17
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)		544										
pX, platoon unblocked				0.95			0.95	0.95	0.95	0.95	0.95	
vC, conflicting volume	333			483			731	881	242	689	922	167
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	333			411			670	827	157	626	871	167
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			96			85	96	94	96	96	98
cM capacity (veh/h)	1223			1092			299	277	821	308	261	848
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	11	259	224	44	215	119	106	39				
Volume Left	11	0	0	44	0	0	44	11				
Volume Right	0	0	94	0	0	11	50	17				
cSH	1223	1700	1700	1092	1700	1700	422	396				
Volume to Capacity	0.01	0.15	0.13	0.04	0.13	0.07	0.25	0.10				
Queue Length 95th (ft)	1	0	0	3	0	0	24	8				
Control Delay (s)	8.0	0.0	0.0	8.4	0.0	0.0	16.3	15.1				
Lane LOS	A			A			C	C				
Approach Delay (s)	0.2			1.0			16.3	15.1				
Approach LOS							C	C				
Intersection Summary												
Average Delay	2.7											
Intersection Capacity Utilization	34.4%			ICU Level of Service						A		
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
11: Tavern Road & Old Mammoth Road

Saturday Peak - Alternative 3
10/12/2010

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	20	5	35	5	5	15	45	365	5	10	650	35
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	6	39	6	6	17	50	406	6	11	722	39
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	760											
pX, platoon unblocked												
vC, conflicting volume	1289	1275	742	1294	1292	408	761	411				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1289	1275	742	1294	1292	408	761	411				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	82	96	91	95	96	97	94	99				
cM capacity (veh/h)	126	156	416	117	152	643	851	1148				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	67	28	50	411	11	761						
Volume Left	22	6	50	0	11	0						
Volume Right	39	17	0	6	0	39						
cSH	218	252	851	1700	1148	1700						
Volume to Capacity	0.31	0.11	0.06	0.24	0.01	0.45						
Queue Length 95th (ft)	31	9	5	0	1	0						
Control Delay (s)	28.6	21.0	9.5	0.0	8.2	0.0						
Lane LOS	D	C	A		A							
Approach Delay (s)	28.6	21.0	1.0		0.1							
Approach LOS	D	C										
Intersection Summary												
Average Delay	2.3											
Intersection Capacity Utilization	49.9%			ICU Level of Service				A				
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
12: Sierra Nevada Road & Old Mammoth Road

Saturday Peak - Alternative 3
10/12/2010










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	20	15	80	20	20	30	70	385	5	45	595	45
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	17	89	22	22	33	78	428	6	50	661	50
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	773											
pX, platoon unblocked												
vC, conflicting volume	1414	1375	686	1444	1397	431	711	433				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1414	1375	686	1444	1397	431	711	433				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	74	87	80	69	82	95	91	96				
cM capacity (veh/h)	85	127	447	71	123	625	888	1126				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	128	78	78	433	50	711						
Volume Left	22	22	78	0	50	0						
Volume Right	89	33	0	6	0	50						
cSH	216	143	888	1700	1126	1700						
Volume to Capacity	0.59	0.55	0.09	0.25	0.04	0.42						
Queue Length 95th (ft)	83	67	7	0	3	0						
Control Delay (s)	43.3	57.0	9.4	0.0	8.3	0.0						
Lane LOS	E	F	A		A							
Approach Delay (s)	43.3	57.0	1.4		0.5							
Approach LOS	E	F										
Intersection Summary												
Average Delay	7.5											
Intersection Capacity Utilization	55.9%			ICU Level of Service				B				
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis 13: Meridian Boulevard & Majestic Pines Drive

Saturday Peak - Alternative 3
10/12/2010

























						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	60	435	220	70	50	40
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	67	483	244	78	56	44
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	322				658	161
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	322				658	161
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				85	95
cM capacity (veh/h)	1234				376	855
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	228	322	163	159	100	
Volume Left	67	0	0	0	56	
Volume Right	0	0	0	78	44	
cSH	1234	1700	1700	1700	500	
Volume to Capacity	0.05	0.19	0.10	0.09	0.20	
Queue Length 95th (ft)	4	0	0	0	18	
Control Delay (s)	2.7	0.0	0.0	0.0	14.0	
Lane LOS	A				B	
Approach Delay (s)	1.1		0.0		14.0	
Approach LOS					B	
Intersection Summary						
Average Delay			2.1			
Intersection Capacity Utilization			37.3%		ICU Level of Service	A
Analysis Period (min)			15			

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis

Saturday Peak - Alternative 3
10/12/2010

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.96		1.00	0.93		1.00	0.98		1.00	0.98		1.00	0.98
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1770	3411		1770	3305		1770	1830		1770	1816		1770	1816
Flt Permitted	0.36	1.00		0.43	1.00		0.33	1.00		0.43	1.00		0.43	1.00
Satd. Flow (perm)	668	3411		796	3305		620	1830		799	1816		799	1816
Volume (vph)	140	315	100	35	190	150	55	190	25	320	450	90		
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	156	350	111	39	211	167	61	211	28	356	500	100		
RTOR Reduction (vph)	0	33	0	0	131	0	0	5	0	0	8	0		
Lane Group Flow (vph)	156	428	0	39	247	0	61	234	0	356	592	0		
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt				
Protected Phases	5	2		1	6		3	8		7	4			
Permitted Phases	2			6			8			4				
Actuated Green, G (s)	24.2	18.4		18.6	15.6		25.3	22.3		40.6	33.5			
Effective Green, g (s)	25.2	19.3		19.6	16.5		26.3	23.2		41.5	34.4			
Actuated g/C Ratio	0.33	0.25		0.26	0.22		0.35	0.31		0.55	0.45			
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9		4.1	4.9			
Vehicle Extension (s)	2.5	5.0		2.5	5.0		2.5	5.0		2.5	5.0			
Lane Grp Cap (vph)	307	867		245	718		262	559		620	823			
v/s Ratio Prot	c0.04	0.13		0.01	0.07		0.01	0.13		c0.11	c0.33			
v/s Ratio Perm	c0.13			0.03			0.07			0.21				
v/c Ratio	0.51	0.49		0.16	0.34		0.23	0.42		0.57	0.72			
Uniform Delay, d1	18.9	24.1		21.4	25.1		17.0	21.0		10.4	16.8			
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00			
Incremental Delay, d2	1.0	0.9		0.2	0.6		0.3	1.1		1.1	3.8			
Delay (s)	19.8	25.1		21.6	25.7		17.3	22.0		11.4	20.6			
Level of Service	B	C		C	C		B	C		B	C			
Approach Delay (s)		23.7			25.3			21.1			17.2			
Approach LOS		C			C			C			B			
Intersection Summary														
HCM Average Control Delay	20.9			HCM Level of Service						C				
HCM Volume to Capacity ratio	0.67													
Actuated Cycle Length (s)	75.9			Sum of lost time (s)						16.0				
Intersection Capacity Utilization	65.3%			ICU Level of Service						C				
Analysis Period (min)	15													
c Critical Lane Group														

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis
15: Meridian Boulevard & Old Mammoth Road

Saturday Peak - Alternative 3
10/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flt	1.00	0.98		1.00	0.97		1.00	1.00		0.85	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3461		1770	3448		1770	1863		1583	1770	1583
Flt Permitted	0.35	1.00		0.18	1.00		0.32	1.00		0.49	1.00	1.00
Satd. Flow (perm)	660	3461		337	3448		597	1863		1583	920	1863
Volume (vph)	175	670	115	105	360	75	130	230	50	120	310	55
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	194	744	128	117	400	83	144	256	56	133	344	61
RTOR Reduction (vph)	0	16	0	0	19	0	0	0	39	0	0	44
Lane Group Flow (vph)	194	856	0	117	464	0	144	256	17	133	344	17
Turn Type	pm+pt			pm+pt			pm+pt		Perm	pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	31.7	24.2		27.3	22.0		26.2	20.7	20.7	24.6	19.9	19.9
Effective Green, g (s)	32.7	25.1		28.3	22.9		27.2	21.6	21.6	25.6	20.8	20.8
Actuated g/C Ratio	0.45	0.34		0.39	0.31		0.37	0.30	0.30	0.35	0.29	0.29
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9	4.9	4.1	4.9	4.9
Vehicle Extension (s)	2.5	3.7		2.5	3.8		2.5	3.8	3.8	2.5	3.8	3.8
Lane Grp Cap (vph)	412	1192		237	1083		313	552	469	379	532	452
v/s Ratio Prot	c0.05	c0.25		0.04	0.13		c0.04	0.14		0.02	c0.18	
v/s Ratio Perm	0.16			0.15			0.14		0.01	0.10		0.01
v/c Ratio	0.47	0.72		0.49	0.43		0.46	0.46	0.04	0.35	0.65	0.04
Uniform Delay, d1	12.8	20.8		15.5	19.8		16.3	20.9	18.2	16.7	22.8	18.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	2.2		1.2	0.4		0.8	0.8	0.0	0.4	2.9	0.0
Delay (s)	13.4	23.0		16.7	20.2		17.0	21.7	18.3	17.1	25.8	18.9
Level of Service	B	C		B	C		B	C	B	B	C	B
Approach Delay (s)		21.3			19.5			19.8			22.8	
Approach LOS		C			B			B			C	
Intersection Summary												
HCM Average Control Delay		20.9										
HCM Volume to Capacity ratio		0.66										
Actuated Cycle Length (s)		72.9							16.0			
Intersection Capacity Utilization		64.9%										
Analysis Period (min)		15										
c Critical Lane Group												


















HCM Unsignalized Intersection Capacity Analysis
16: Meridian Boulevard & Sierra Park Road

Saturday Peak - Alternative 3
10/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	45	145	5	5	140	15	25	5	5	15	5	75
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	50	161	6	6	156	17	28	6	6	17	6	83
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total (vph)	131	86	83	94	39	106						
Volume Left (vph)	50	0	6	0	28	17						
Volume Right (vph)	0	6	0	17	6	83						
Hadj (s)	0.23	-0.01	0.07	-0.09	0.09	-0.41						
Departure Headway (s)	5.2	5.0	5.1	5.0	5.0	4.5						
Degree Utilization, x	0.19	0.12	0.12	0.13	0.05	0.13						
Capacity (veh/h)	666	692	671	695	659	744						
Control Delay (s)	8.3	7.5	7.6	7.5	8.3	8.1						
Approach Delay (s)	8.0		7.6		8.3	8.1						
Approach LOS	A		A		A	A						
Intersection Summary												
Delay		7.9										
HCM Level of Service		A										
Intersection Capacity Utilization		26.5%										
Analysis Period (min)		15										






















HCM Unsignalized Intersection Capacity Analysis
17: Chateau Road & Old Mammoth Road

Saturday Peak - Alternative 3
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop		Free				Free	
Grade	0%				0%		0%				0%	
Volume (veh/h)	30	30	10	10	20	55	10	275	10	95	335	70
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	33	33	11	11	22	61	11	306	11	106	372	78
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)	1037											
pX, platoon unblocked												
vC, conflicting volume	1022	961	411	944	994	311	450	317				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1022	961	411	944	994	311	450	317				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	80	86	98	94	90	92	99	92				
cM capacity (veh/h)	168	232	641	197	222	729	1110	1243				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	78	94	11	317	106	450						
Volume Left	33	11	11	0	106	0						
Volume Right	11	61	0	11	0	78						
cSH	217	393	1110	1700	1243	1700						
Volume to Capacity	0.36	0.24	0.01	0.19	0.08	0.26						
Queue Length 95th (ft)	39	23	1	0	7	0						
Control Delay (s)	30.6	17.0	8.3	0.0	8.2	0.0						
Lane LOS	D	C	A		A							
Approach Delay (s)	30.6	17.0	0.3	1.6								
Approach LOS	D	C										
Intersection Summary												
Average Delay	4.7											
Intersection Capacity Utilization	45.3%		ICU Level of Service				A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
18: Old Mammoth Road & Minaret Road













Saturday Peak - Alternative 3
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	105	160	45	135	185	90	20	65	90	100	155	200
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	117	178	50	150	206	100	22	72	100	111	172	222
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)	2											
Median type	None											
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	306			228			1250	1042	203	1053	1017	256
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	306			228			1250	1042	203	1053	1017	256
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	91			89			0	61	88	0	10	72
cM capacity (veh/h)	1255			1340			21	185	838	108	191	783
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	117	228	150	306	194	111	394					
Volume Left	117	0	150	0	22	111	0					
Volume Right	0	50	0	100	100	0	222					
cSH	1255	1700	1340	1700	243	108	333					
Volume to Capacity	0.09	0.13	0.11	0.18	0.80	1.03	1.18					
Queue Length 95th (ft)	8	0	9	0	151	167	414					
Control Delay (s)	8.2	0.0	8.0	0.0	60.9	170.1	143.4					
Lane LOS	A		A		F	F	F					
Approach Delay (s)	2.8	2.6		60.9		149.3						
Approach LOS				F		F						
Intersection Summary												
Average Delay	59.6											
Intersection Capacity Utilization	51.9%			ICU Level of Service					A			
Analysis Period (min)	15											

Future - Alternative 4 LOS Reports














HCM Unsignalized Intersection Capacity Analysis
1: Forest Trail & Minaret Road

Saturday Peak - Alternative 4
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕				↕			↕			↕	
Sign Control	Stop				Stop			Free			Free	
Grade	0%				0%			0%			0%	
Volume (veh/h)	20	30	95	20	20	15	75	185	35	85	720	105
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	33	106	22	22	17	83	206	39	94	800	117
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1467	1458	858	1561	1497	225	917	244				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1467	1458	858	1561	1497	225	917	244				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	70	69	70	48	78	98	89	93				
cM capacity (veh/h)	75	107	356	42	101	814	744	1322				
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	161	61	328	1011								
Volume Left	22	22	83	94								
Volume Right	106	17	39	117								
cSH	178	80	744	1322								
Volume to Capacity	0.91	0.77	0.11	0.07								
Queue Length 95th (ft)	170	94	9	6								
Control Delay (s)	97.1	132.6	3.7	1.9								
Lane LOS	F	F	A	A								
Approach Delay (s)	97.1	132.6	3.7	1.9								
Approach LOS	F	F										
Intersection Summary												
Average Delay			17.2									
Intersection Capacity Utilization			69.2%	ICU Level of Service				C				
Analysis Period (min)			15									













HCM Unsignalized Intersection Capacity Analysis
2: Lake Mary Road & Davidson

Saturday Peak - Alternative 4
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Free				Free				Stop		Stop	
Grade	0%				0%				0%		0%	
Volume (veh/h)	0	100	15	85	100	45	10	0	70	70	0	5
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	111	17	94	111	50	11	0	78	78	0	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type									None		None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	161				128				450	469	119	483
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	161				128				450	469	119	483
tC, single (s)	4.1				4.1				7.1	6.5	6.2	7.1
tC, 2 stage (s)												
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5
p0 queue free %	100				94				98	100	92	82
cM capacity (veh/h)	1418				1458				491	460	932	430
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	128	256	89	83								
Volume Left	0	94	11	78								
Volume Right	17	50	78	6								
cSH	1418	1458	1065	446								
Volume to Capacity	0.00	0.06	0.08	0.19								
Queue Length 95th (ft)	0	5	7	17								
Control Delay (s)	0.0	3.2	9.6	14.9								
Lane LOS		A	A	B								
Approach Delay (s)	0.0	3.2	9.6	14.9								
Approach LOS			A	B								
Intersection Summary												
Average Delay				5.2								
Intersection Capacity Utilization	36.9%			ICU Level of Service					A			
Analysis Period (min)				15								

























HCM Signalized Intersection Capacity Analysis
3: Lake Mary Road & Canyon Boulevard

Saturday Peak - Alternative 4
10/12/2010

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.97	
Flt	1.00	1.00	1.00	0.85	1.00	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1770	1863	1863	1583	3432	
Flt Permitted	0.59	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1092	1863	1863	1583	3432	
Volume (vph)	25	220	255	255	535	15
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	28	244	283	283	594	17
RTOR Reduction (vph)	0	0	0	124	6	0
Lane Group Flow (vph)	28	244	283	159	605	0
Turn Type	Perm			Perm		
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	24.7	24.7	24.7	24.7	11.6	
Effective Green, g (s)	25.3	25.3	25.3	25.3	11.7	
Actuated g/C Ratio	0.56	0.56	0.56	0.56	0.26	
Clearance Time (s)	4.6	4.6	4.6	4.6	4.1	
Vehicle Extension (s)	6.1	6.1	6.1	6.1	2.0	
Lane Grp Cap (vph)	614	1047	1047	890	892	
v/s Ratio Prot		0.13	c0.15		c0.18	
v/s Ratio Perm	0.03			0.10		
v/c Ratio	0.05	0.23	0.27	0.18	0.68	
Uniform Delay, d1	4.4	5.0	5.1	4.8	15.0	
Progression Factor	1.00	1.00	0.45	0.85	1.00	
Incremental Delay, d2	0.1	0.5	0.5	0.3	1.6	
Delay (s)	4.6	5.5	2.8	4.4	16.6	
Level of Service	A	A	A	A	B	
Approach Delay (s)		5.4	3.6		16.6	
Approach LOS		A	A		B	
Intersection Summary						
HCM Average Control Delay		9.4		HCM Level of Service	A	
HCM Volume to Capacity ratio		0.40				
Actuated Cycle Length (s)		45.0		Sum of lost time (s)	8.0	
Intersection Capacity Utilization		43.2%		ICU Level of Service	A	
Analysis Period (min)		15				
c Critical Lane Group						

















HCM Signalized Intersection Capacity Analysis
4: Lake Mary Road & Minaret Road

Saturday Peak - Alternative 4
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	3433	1675	
Flt Permitted	0.36	1.00	1.00	0.29	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	665	3539	1583	539	3539	1583	1770	1863	1583	3433	1675	
Volume (vph)	120	465	175	85	355	145	430	315	100	545	70	145
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	133	517	194	94	394	161	478	350	111	606	78	161
RTOR Reduction (vph)	0	0	84	0	0	126	0	0	76	0	83	0
Lane Group Flow (vph)	133	517	110	94	394	35	478	350	35	606	156	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases	2		2	6		6			8			
Actuated Green, G (s)	25.6	19.6	19.6	23.2	18.4	18.4	27.1	27.1	27.1	20.0	20.0	
Effective Green, g (s)	26.6	20.5	20.5	24.2	19.3	19.3	28.0	28.0	28.0	20.6	20.6	
Actuated g/C Ratio	0.30	0.23	0.23	0.27	0.21	0.21	0.31	0.31	0.31	0.23	0.23	
Clearance Time (s)	4.1	4.9	4.9	4.1	4.9	4.9	4.9	4.9	4.9	4.6	4.6	
Vehicle Extension (s)	2.5	4.7	4.7	2.5	4.6	4.6	5.2	5.2	5.2	6.2	6.2	
Lane Grp Cap (vph)	271	806	361	212	759	339	551	580	492	786	383	
v/s Ratio Prot	c0.03	c0.15		0.02	0.11		c0.27	0.19		c0.18	0.09	
v/s Ratio Perm	0.11		0.07	0.10		0.02			0.02			
v/c Ratio	0.49	0.64	0.30	0.44	0.52	0.10	0.87	0.60	0.07	0.77	0.41	
Uniform Delay, d1	24.4	31.4	28.8	25.7	31.2	28.4	29.2	26.3	21.8	32.5	29.5	
Progression Factor	0.82	0.84	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.9	3.3	1.8	1.1	2.5	0.6	16.7	4.6	0.3	7.2	3.2	
Delay (s)	21.0	29.6	26.5	26.8	33.8	29.0	46.0	30.9	22.1	39.7	32.7	
Level of Service	C	C	C	C	C	C	D	C	C	D	C	
Approach Delay (s)		27.5			31.6			37.5			37.7	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM Average Control Delay		33.8		HCM Level of Service					C			
HCM Volume to Capacity ratio		0.72										
Actuated Cycle Length (s)		90.0		Sum of lost time (s)					12.0			
Intersection Capacity Utilization		67.6%		ICU Level of Service					C			
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
5: Main Street & Mountain Boulevard

Saturday Peak - Alternative 4
10/12/2010



















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Volume (veh/h)	30	1330	70	30	620	95	10	25	20	65	20	65
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	33	1478	78	33	689	106	11	28	22	72	22	72
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	794				1556				2078	2444	778	1650
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	794				1556				2078	2444	778	1650
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5
tC, 2 stage (s)												
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5
p0 queue free %	96				92				0	0	93	0
cM capacity (veh/h)	823				422				8	27	339	0
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	772	817	378	450	61	167						
Volume Left	33	0	33	0	11	72						
Volume Right	0	78	0	106	22	72						
cSH	823	1700	422	1700	25	0						
Volume to Capacity	0.04	0.48	0.08	0.26	2.40	Err						
Queue Length 95th (ft)	3	0	6	0	188	Err						
Control Delay (s)	1.1	0.0	2.5	0.0	962.2	Err						
Lane LOS	A	A		F		F						
Approach Delay (s)	0.5	1.2			962.2	Err						
Approach LOS					F	F						
Intersection Summary												
Average Delay	Err											
Intersection Capacity Utilization	82.5%			ICU Level of Service			E					
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
6: Main Street & Center Street

Saturday Peak - Alternative 4
10/12/2010




















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Volume (veh/h)	75	1055	0	95	45	715	45	10	95	45	0	35
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	83	1172	0	106	50	794	50	11	106	50	0	39
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)	1207											
pX, platoon unblocked												
vC, conflicting volume	844				1172				1614	2394	586	1522
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	844				1172				1614	2394	586	1522
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5
tC, 2 stage (s)												
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5
p0 queue free %	89				82				3	54	77	0
cM capacity (veh/h)	788				592				51	24	453	32
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	83	781	391	106	33	811	167	89				
Volume Left	83	0	0	106	0	0	50	50				
Volume Right	0	0	0	0	0	794	106	39				
cSH	788	1700	1700	592	1700	1700	100	55				
Volume to Capacity	0.11	0.46	0.23	0.18	0.02	0.48	1.66	1.61				
Queue Length 95th (ft)	9	0	0	16	0	0	327	206				
Control Delay (s)	10.1	0.0	0.0	12.4	0.0	0.0	411.3	463.1				
Lane LOS	B				B				F	F		
Approach Delay (s)	0.7				1.4				411.3	463.1		
Approach LOS							F	F				
Intersection Summary												
Average Delay	45.5											
Intersection Capacity Utilization	53.8%			ICU Level of Service					A			
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
7: Main Street & Forest Trail

Saturday Peak - Alternative 4
10/12/2010

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Sign Control		Free			Free			Stop			Stop		
Grade		0%			0%			0%			0%		
Volume (veh/h)	20	1175	20	15	720	70	20	0	25	145	5	35	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	22	1306	22	17	800	78	22	0	28	161	6	39	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)												1	
Median type							None			None			
Median storage (veh)													
Upstream signal (ft)	793												
pX, platoon unblocked													
vC, conflicting volume	878			1328				1797	2272	664	1597	2244	439
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	878			1328				1797	2272	664	1597	2244	439
tC, single (s)	4.1			4.1				7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			2.2				3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			97				44	100	93	0	86	93
cM capacity (veh/h)	765			516				40	37	403	63	39	566
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1					
Volume Total	22	870	457	17	533	344	50	206					
Volume Left	22	0	0	17	0	0	22	161					
Volume Right	0	0	22	0	0	78	28	39					
cSH	765	1700	1700	516	1700	1700	80	75					
Volume to Capacity	0.03	0.51	0.27	0.03	0.31	0.20	0.63	2.76					
Queue Length 95th (ft)	2	0	0	2	0	0	71	505					
Control Delay (s)	9.8	0.0	0.0	12.2	0.0	0.0	106.6	912.8					
Lane LOS	A			B				F	F				
Approach Delay (s)	0.2			0.2				106.6	912.8				
Approach LOS							F	F					
Intersection Summary													
Average Delay	77.4												
Intersection Capacity Utilization	54.7%			ICU Level of Service					A				
Analysis Period (min)	15												







HCM Unsignalized Intersection Capacity Analysis
8: Main Street & Laurel Mountain Road

Saturday Peak - Alternative 4
10/12/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1010	0	190	20	110	30
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1122	0	211	22	122	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)				505		
pX, platoon unblocked						
vC, conflicting volume			1122		1556	561
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1122		1556	561
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			66		0	93
cM capacity (veh/h)			618		68	471
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	748	374	211	11	11	156
Volume Left	0	0	211	0	0	122
Volume Right	0	0	0	0	0	33
cSH	1700	1700	618	1700	1700	84
Volume to Capacity	0.44	0.22	0.34	0.01	0.01	1.86
Queue Length 95th (ft)	0	0	38	0	0	334
Control Delay (s)	0.0	0.0	13.8	0.0	0.0	513.7
Lane LOS			B			F
Approach Delay (s)	0.0		12.5			513.7
Approach LOS						F
Intersection Summary						
Average Delay	54.8					
Intersection Capacity Utilization	56.4%		ICU Level of Service			B
Analysis Period (min)	15					

HCM Signalized Intersection Capacity Analysis
9: Main Street & Old Mammoth Road

Saturday Peak - Alternative 4
10/12/2010























						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↓	↑↑	↓	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	1770	1583
Flt Permitted	1.00	1.00	0.37	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	690	3539	1770	1583
Volume (vph)	385	495	90	285	275	70
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	428	550	100	317	306	78
RTOR Reduction (vph)	0	381	0	0	0	47
Lane Group Flow (vph)	428	169	100	317	306	31
Turn Type	Perm		pm+pt	Perm		
Protected Phases	2	1		6	3	
Permitted Phases	2		6	3		
Actuated Green, G (s)	16.6	16.6	25.2	25.2	22.4	22.4
Effective Green, g (s)	17.5	17.5	26.1	26.1	23.0	23.0
Actuated g/C Ratio	0.31	0.31	0.46	0.46	0.40	0.40
Clearance Time (s)	4.9	4.9	4.1	4.9	4.6	4.6
Vehicle Extension (s)	5.2	5.2	2.5	5.2	5.2	5.2
Lane Grp Cap (vph)	1085	485	402	1618	713	638
v/s Ratio Prot	c0.12	c0.02		0.09	c0.17	
v/s Ratio Perm	0.11		0.09	0.02		
v/c Ratio	0.39	0.35	0.25	0.20	0.43	0.05
Uniform Delay, d1	15.6	15.4	9.2	9.2	12.3	10.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.0	0.2	0.1	1.9	0.1
Delay (s)	16.2	16.3	9.5	9.4	14.2	10.5
Level of Service	B	B	A	A	B	B
Approach Delay (s)	16.3			9.4	13.5	
Approach LOS	B			A	B	
Intersection Summary						
HCM Average Control Delay			14.0	HCM Level of Service		B
HCM Volume to Capacity ratio			0.40			
Actuated Cycle Length (s)			57.1	Sum of lost time (s)		12.0
Intersection Capacity Utilization			42.3%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
10: Main Street & Sierra Park Boulevard

Saturday Peak - Alternative 4
10/12/2010


















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	10	375	85	40	310	10	40	10	50	10	10	15
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	417	94	44	344	11	44	11	56	11	11	17
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)		544										
pX, platoon unblocked				0.94			0.94	0.94	0.94	0.94	0.94	
vC, conflicting volume	356			511			769	931	256	731	972	178
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	356			422			696	866	151	654	911	178
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			96			84	96	93	96	95	98
cM capacity (veh/h)	1200			1070			282	259	819	288	244	835
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	11	278	233	44	230	126	111	39				
Volume Left	11	0	0	44	0	0	44	11				
Volume Right	0	0	94	0	0	11	56	17				
cSH	1200	1700	1700	1070	1700	1700	414	374				
Volume to Capacity	0.01	0.16	0.14	0.04	0.14	0.07	0.27	0.10				
Queue Length 95th (ft)	1	0	0	3	0	0	27	9				
Control Delay (s)	8.0	0.0	0.0	8.5	0.0	0.0	16.9	15.7				
Lane LOS	A			A			C	C				
Approach Delay (s)	0.2			0.9			16.9	15.7				
Approach LOS							C	C				
Intersection Summary												
Average Delay				2.8								
Intersection Capacity Utilization	35.3%			ICU Level of Service			A					
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
11: Tavern Road & Old Mammoth Road

Saturday Peak - Alternative 4
10/12/2010

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop		Free				Free	
Grade	0%				0%		0%				0%	
Volume (veh/h)	30	10	55	5	10	15	65	375	5	10	710	50
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	33	11	61	6	11	17	72	417	6	11	789	56
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	760											
pX, platoon unblocked												
vC, conflicting volume	1422	1406	817	1442	1431	419	844	422				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1422	1406	817	1442	1431	419	844	422				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	65	91	84	93	91	97	91	99				
cM capacity (veh/h)	95	125	377	80	121	634	792	1137				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	106	33	72	422	11	844						
Volume Left	33	6	72	0	11	0						
Volume Right	61	17	0	6	0	56						
cSH	176	177	792	1700	1137	1700						
Volume to Capacity	0.60	0.19	0.09	0.25	0.01	0.50						
Queue Length 95th (ft)	82	17	8	0	1	0						
Control Delay (s)	52.4	29.9	10.0	0.0	8.2	0.0						
Lane LOS	F	D	B		A							
Approach Delay (s)	52.4	29.9	1.5	0.1								
Approach LOS	F	D										
Intersection Summary												
Average Delay	4.9											
Intersection Capacity Utilization	63.8%			ICU Level of Service				B				
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
12: Sierra Nevada Road & Old Mammoth Road

Saturday Peak - Alternative 4
10/12/2010










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	20	15	85	20	20	35	75	445	5	45	685	45
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	17	94	22	22	39	83	494	6	50	761	50
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	773											
pX, platoon unblocked	0.96	0.96		0.96	0.96	0.96				0.96		
vC, conflicting volume	1597	1553	786	1628	1575	497	811			500		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1620	1574	786	1652	1597	478	811			481		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	58	82	76	49	75	93	90			95		
cM capacity (veh/h)	53	90	392	44	88	566	815			1041		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	133	83	83	500	50	811						
Volume Left	22	22	83	0	50	0						
Volume Right	94	39	0	6	0	50						
cSH	158	101	815	1700	1041	1700						
Volume to Capacity	0.84	0.83	0.10	0.29	0.05	0.48						
Queue Length 95th (ft)	142	115	9	0	4	0						
Control Delay (s)	91.7	123.9	9.9	0.0	8.6	0.0						
Lane LOS	F	F	A		A							
Approach Delay (s)	91.7	123.9	1.4	0.5								
Approach LOS	F	F										
Intersection Summary												
Average Delay	14.3											
Intersection Capacity Utilization	61.3%			ICU Level of Service					B			
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
13: Meridian Boulevard & Majestic Pines Drive

Saturday Peak - Alternative 4
10/12/2010





















						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control	Free	Free	Free		Stop	
Grade	0%	0%	0%		0%	
Volume (veh/h)	60	440	220	75	50	40
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	67	489	244	83	56	44
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	328				664	164
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	328				664	164
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				85	95
cM capacity (veh/h)	1229				372	852
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	230	326	163	165	100	
Volume Left	67	0	0	0	56	
Volume Right	0	0	0	83	44	
cSH	1229	1700	1700	1700	497	
Volume to Capacity	0.05	0.19	0.10	0.10	0.20	
Queue Length 95th (ft)	4	0	0	0	19	
Control Delay (s)	2.7	0.0	0.0	0.0	14.1	
Lane LOS	A				B	
Approach Delay (s)	1.1		0.0		14.1	
Approach LOS					B	
Intersection Summary						
Average Delay		2.1				
Intersection Capacity Utilization		37.6%		ICU Level of Service		A
Analysis Period (min)		15				

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis
14: Meridian Boulevard & Minaret Road

Saturday Peak - Alternative 4
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.94		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3417		1770	3311		1770	1831		1770	1816	
Flt Permitted	0.34	1.00		0.40	1.00		0.34	1.00		0.42	1.00	
Satd. Flow (perm)	629	3417		751	3311		637	1831		777	1816	
Volume (vph)	145	335	100	35	205	155	55	195	25	335	450	90
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	161	372	111	39	228	172	61	217	28	372	500	100
RTOR Reduction (vph)	0	30	0	0	135	0	0	5	0	0	8	0
Lane Group Flow (vph)	161	453	0	39	265	0	61	240	0	372	592	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	24.3	18.5		18.7	15.7		25.0	22.0		40.9	33.8	
Effective Green, g (s)	25.3	19.4		19.7	16.6		26.0	22.9		41.8	34.7	
Actuated g/C Ratio	0.33	0.25		0.26	0.22		0.34	0.30		0.55	0.45	
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9		4.1	4.9	
Vehicle Extension (s)	2.5	5.0		2.5	5.0		2.5	5.0		2.5	5.0	
Lane Grp Cap (vph)	297	869		235	720		263	550		620	826	
v/s Ratio Prot	c0.04	0.13		0.01	0.08		0.01	0.13		c0.12	c0.33	
v/s Ratio Perm	c0.14			0.04			0.07			0.21		
v/c Ratio	0.54	0.52		0.17	0.37		0.23	0.44		0.60	0.72	
Uniform Delay, d1	19.1	24.5		21.5	25.4		17.3	21.5		10.6	16.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	1.1		0.2	0.7		0.3	1.2		1.4	3.7	
Delay (s)	20.7	25.5		21.8	26.1		17.7	22.7		12.0	20.5	
Level of Service	C	C		C	C		B	C		B	C	
Approach Delay (s)		24.3			25.7			21.7			17.2	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay	21.3			HCM Level of Service					C			
HCM Volume to Capacity ratio	0.68											
Actuated Cycle Length (s)	76.3			Sum of lost time (s)					16.0			
Intersection Capacity Utilization	66.2%			ICU Level of Service					C			
Analysis Period (min)	15											
c Critical Lane Group												

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis
15: Meridian Boulevard & Old Mammoth Road

Saturday Peak - Alternative 4
10/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flt	1.00	0.98		1.00	0.97		1.00	1.00		0.85	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3459		1770	3446		1770	1863		1583	1770	1863
Flt Permitted	0.34	1.00		0.17	1.00		0.27	1.00		0.44	1.00	1.00
Satd. Flow (perm)	626	3459		309	3446		499	1863		1583	822	1863
Volume (vph)	190	700	125	110	375	80	145	260	55	125	345	65
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	211	778	139	122	417	89	161	289	61	139	383	72
RTOR Reduction (vph)	0	16	0	0	20	0	0	0	43	0	0	51
Lane Group Flow (vph)	211	901	0	122	486	0	161	289	18	139	383	21
Turn Type	pm+pt			pm+pt			pm+pt		Perm	pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	33.5	25.7		28.5	23.2		27.2	21.7	21.7	25.6	20.9	20.9
Effective Green, g (s)	34.5	26.6		29.5	24.1		28.2	22.6	22.6	26.6	21.8	21.8
Actuated g/C Ratio	0.46	0.35		0.39	0.32		0.37	0.30	0.30	0.35	0.29	0.29
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9	4.9	4.1	4.9	4.9
Vehicle Extension (s)	2.5	3.7		2.5	3.8		2.5	3.8	3.8	2.5	3.8	3.8
Lane Grp Cap (vph)	406	1220		226	1101		281	558	474	350	539	458
v/s Ratio Prot	c0.05	c0.26		0.04	0.14		c0.04	0.16		0.03	c0.21	
v/s Ratio Perm	0.18			0.17			0.17		0.01	0.11		0.01
v/c Ratio	0.52	0.74		0.54	0.44		0.57	0.52	0.04	0.40	0.71	0.05
Uniform Delay, d1	13.1	21.4		16.1	20.3		17.3	21.9	18.7	17.4	24.0	19.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	2.5		1.9	0.4		2.3	1.0	0.0	0.5	4.6	0.1
Delay (s)	13.9	23.8		18.0	20.7		19.6	22.9	18.7	17.9	28.6	19.4
Level of Service	B	C		B	C		B	C	B	B	C	B
Approach Delay (s)		22.0			20.2			21.4			25.0	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay		22.1			HCM Level of Service			C				
HCM Volume to Capacity ratio		0.71										
Actuated Cycle Length (s)		75.4			Sum of lost time (s)			16.0				
Intersection Capacity Utilization		69.0%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												

















HCM Unsignalized Intersection Capacity Analysis
16: Meridian Boulevard & Sierra Park Road

Saturday Peak - Alternative 4
10/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	45	145	5	5	140	15	25	5	5	15	5	75
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	50	161	6	6	156	17	28	6	6	17	6	83
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total (vph)	131	86	83	94	39	106						
Volume Left (vph)	50	0	6	0	28	17						
Volume Right (vph)	0	6	0	17	6	83						
Hadj (s)	0.23	-0.01	0.07	-0.09	0.09	-0.41						
Departure Headway (s)	5.2	5.0	5.1	5.0	5.0	4.5						
Degree Utilization, x	0.19	0.12	0.12	0.13	0.05	0.13						
Capacity (veh/h)	666	692	671	695	659	744						
Control Delay (s)	8.3	7.5	7.6	7.5	8.3	8.1						
Approach Delay (s)	8.0		7.6		8.3	8.1						
Approach LOS	A		A		A	A						
Intersection Summary												
Delay		7.9										
HCM Level of Service		A										
Intersection Capacity Utilization		26.5%			ICU Level of Service					A		
Analysis Period (min)		15										

HCM Unsignalized Intersection Capacity Analysis
17: Chateau Road & Old Mammoth Road

Saturday Peak - Alternative 4
10/12/2010























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	30	35	10	10	20	60	10	305	10	105	375	75
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	33	39	11	11	22	67	11	339	11	117	417	83
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	1037											
pX, platoon unblocked	0.97	0.97	0.97	0.97	0.97		0.97					
vC, conflicting volume	1131	1064	458	1047	1100	344	500	350				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1135	1066	441	1049	1103	344	484	350				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	75	80	98	93	88	90	99	90				
cM capacity (veh/h)	131	193	597	152	183	698	1045	1209				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	83	100	11	350	117	500						
Volume Left	33	11	11	0	117	0						
Volume Right	11	67	0	11	0	83						
cSH	176	345	1045	1700	1209	1700						
Volume to Capacity	0.47	0.29	0.01	0.21	0.10	0.29						
Queue Length 95th (ft)	57	29	1	0	8	0						
Control Delay (s)	42.7	19.6	8.5	0.0	8.3	0.0						
Lane LOS	E	C	A		A							
Approach Delay (s)	42.7	19.6	0.3		1.6							
Approach LOS	E	C										
Intersection Summary												
Average Delay	5.7											
Intersection Capacity Utilization	48.1%			ICU Level of Service			A					
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
18: Old Mammoth Road & Minaret Road

Saturday Peak - Alternative 4
10/12/2010

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Sign Control		Free			Free			Stop			Stop			
Grade		0%			0%			0%			0%			
Volume (veh/h)	110	175	45	135	200	95	20	65	90	105	155	200		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90		
Hourly flow rate (vph)	122	194	50	150	222	106	22	72	100	117	172	222		
Pedestrians														
Lane Width (ft)														
Walking Speed (ft/s)														
Percent Blockage														
Right turn flare (veh)									2					
Median type									None	None				
Median storage (veh)														
Upstream signal (ft)														
pX, platoon unblocked														
vC, conflicting volume	328			244			1294	1092	219	1100	1064	275		
vC1, stage 1 conf vol														
vC2, stage 2 conf vol														
vCu, unblocked vol	328			244			1294	1092	219	1100	1064	275		
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2		
tC, 2 stage (s)														
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3		
p0 queue free %	90			89			0	58	88	0	3	71		
cM capacity (veh/h)	1232			1322			10	171	820	96	178	764		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2							
Volume Total	122	244	150	328	194	117	394							
Volume Left	122	0	150	0	22	117	0							
Volume Right	0	50	0	106	100	0	222							
cSH	1232	1700	1322	1700	207	96	313							
Volume to Capacity	0.10	0.14	0.11	0.19	0.94	1.22	1.26							
Queue Length 95th (ft)	8	0	10	0	194	201	456							
Control Delay (s)	8.2	0.0	8.1	0.0	95.1	243.8	174.1							
Lane LOS	A		A		F	F	F							
Approach Delay (s)	2.7		2.5		95.1	190.0								
Approach LOS					F	F								
Intersection Summary														
Average Delay	76.0													
Intersection Capacity Utilization	53.2%			ICU Level of Service					A					
Analysis Period (min)	15													

















LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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Future - Alternative 5 LOS Reports

HCM Unsignalized Intersection Capacity Analysis
1: Forest Trail & Minaret Road

Saturday Peak - Alternative 5
10/12/2010
















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	20	30	90	20	20	15	70	175	30	80	665	100
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	33	100	22	22	17	78	194	33	89	739	111
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1367	1356	794	1456	1394	211	850	228				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1367	1356	794	1456	1394	211	850	228				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	76	73	74	60	81	98	90	93				
cM capacity (veh/h)	92	126	388	56	119	829	788	1340				
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	156	61	306	939								
Volume Left	22	22	78	89								
Volume Right	100	17	33	111								
cSH	203	101	788	1340								
Volume to Capacity	0.76	0.60	0.10	0.07								
Queue Length 95th (ft)	130	72	8	5								
Control Delay (s)	64.1	83.7	3.4	1.7								
Lane LOS	F	F	A	A								
Approach Delay (s)	64.1	83.7	3.4	1.7								
Approach LOS	F	F										
Intersection Summary												
Average Delay	12.1											
Intersection Capacity Utilization	65.1%			ICU Level of Service			C					
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
Page 1

HCM Unsignalized Intersection Capacity Analysis
2: Lake Mary Road & Davidson

Saturday Peak - Alternative 5
10/12/2010













														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Sign Control	Free			Free			Stop			Stop				
Grade	0%			0%			0%			0%				
Volume (veh/h)	0	95	15	80	95	45	10	0	65	65	0	5		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90		
Hourly flow rate (vph)	0	106	17	89	106	50	11	0	72	72	0	6		
Pedestrians														
Lane Width (ft)														
Walking Speed (ft/s)														
Percent Blockage														
Right turn flare (veh)	2													
Median type	None													
Median storage (veh)	None													
Upstream signal (ft)														
pX, platoon unblocked														
vC, conflicting volume	156				122				428	447	114	458	431	131
vC1, stage 1 conf vol														
vC2, stage 2 conf vol														
vCu, unblocked vol	156				122				428	447	114	458	431	131
tC, single (s)	4.1				4.1				7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)														
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100				94				98	100	92	84	100	99
cM capacity (veh/h)	1425				1465				509	476	939	451	486	919
Direction, Lane #	EB 1	WB 1	NB 1	SB 1										
Volume Total	122	244	83	78										
Volume Left	0	89	11	72										
Volume Right	17	50	72	6										
cSH	1425	1465	1083	468										
Volume to Capacity	0.00	0.06	0.08	0.17										
Queue Length 95th (ft)	0	5	6	15										
Control Delay (s)	0.0	3.1	9.6	14.2										
Lane LOS		A	A	B										
Approach Delay (s)	0.0	3.1	9.6	14.2										
Approach LOS		A	B											
Intersection Summary														
Average Delay	5.0													
Intersection Capacity Utilization	36.1%			ICU Level of Service						A				
Analysis Period (min)	15													

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
Page 2

























HCM Signalized Intersection Capacity Analysis
3: Lake Mary Road & Canyon Boulevard

Saturday Peak - Alternative 5
10/12/2010

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	1.00	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1770	1863	1863	1583	3431	
Flt Permitted	0.59	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1103	1863	1863	1583	3431	
Volume (vph)	20	210	245	230	490	15
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	233	272	256	544	17
RTOR Reduction (vph)	0	0	0	109	7	0
Lane Group Flow (vph)	22	233	272	147	554	0
Turn Type	Perm		Perm			
Protected Phases	2		6		4	
Permitted Phases	2		6			
Actuated Green, G (s)	25.2	25.2	25.2	25.2	11.1	
Effective Green, g (s)	25.8	25.8	25.8	25.8	11.2	
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.25	
Clearance Time (s)	4.6	4.6	4.6	4.6	4.1	
Vehicle Extension (s)	6.1	6.1	6.1	6.1	2.0	
Lane Grp Cap (vph)	632	1068	1068	908	854	
v/s Ratio Prot		0.13	c0.15		c0.16	
v/s Ratio Perm	0.02		0.09			
v/c Ratio	0.03	0.22	0.25	0.16	0.65	
Uniform Delay, d1	4.2	4.7	4.8	4.5	15.1	
Progression Factor	1.00	1.00	0.42	0.81	1.00	
Incremental Delay, d2	0.1	0.5	0.5	0.3	1.3	
Delay (s)	4.3	5.2	2.5	3.9	16.4	
Level of Service	A		A		B	
Approach Delay (s)	5.1		3.2		16.4	
Approach LOS	A		A		B	
Intersection Summary						
HCM Average Control Delay	9.1			HCM Level of Service		A
HCM Volume to Capacity ratio	0.37					
Actuated Cycle Length (s)	45.0			Sum of lost time (s)		8.0
Intersection Capacity Utilization	37.7%			ICU Level of Service		A
Analysis Period (min)	15					
c Critical Lane Group						

















HCM Signalized Intersection Capacity Analysis
4: Lake Mary Road & Minaret Road

Saturday Peak - Alternative 5
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	3433	1670	
Flt Permitted	0.37	1.00	1.00	0.31	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	696	3539	1583	581	3539	1583	1770	1863	1583	3433	1670	
Volume (vph)	110	445	155	75	340	135	370	290	90	520	60	135
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	122	494	172	83	378	150	411	322	100	578	67	150
RTOR Reduction (vph)	0	0	78	0	0	118	0	0	69	0	89	0
Lane Group Flow (vph)	122	494	94	83	378	32	411	322	31	578	128	0
Turn Type	pm+pt		Perm		pm+pt		Perm		Split		Perm	
Protected Phases	5		2		1		6		8		8	
Permitted Phases	2		2		6		6		8		7	
Actuated Green, G (s)	25.6	19.6	19.6	23.2	18.4	18.4	27.1	27.1	27.1	20.0	20.0	
Effective Green, g (s)	26.6	20.5	20.5	24.2	19.3	19.3	28.0	28.0	28.0	20.6	20.6	
Actuated g/C Ratio	0.30	0.23	0.23	0.27	0.21	0.21	0.31	0.31	0.31	0.23	0.23	
Clearance Time (s)	4.1	4.9	4.9	4.1	4.9	4.9	4.9	4.9	4.9	4.6	4.6	
Vehicle Extension (s)	2.5	4.7	4.7	2.5	4.6	4.6	5.2	5.2	5.2	6.2	6.2	
Lane Grp Cap (vph)	279	806	361	221	759	339	551	580	492	786	382	
v/s Ratio Prot	c0.03	c0.14		0.02	0.11		c0.23	0.17		c0.17	0.08	
v/s Ratio Perm	0.10		0.06	0.08		0.02			0.02			
v/c Ratio	0.44	0.61	0.26	0.38	0.50	0.09	0.75	0.56	0.06	0.74	0.33	
Uniform Delay, d1	24.2	31.2	28.5	25.5	31.1	28.3	27.8	25.8	21.8	32.2	29.0	
Progression Factor	0.83	0.84	0.87	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	3.0	1.5	0.8	2.3	0.6	8.9	3.8	0.2	6.1	2.3	
Delay (s)	20.9	29.1	26.4	26.3	33.4	28.9	36.7	29.6	22.0	38.2	31.3	
Level of Service	C		C		C		D		C		D	
Approach Delay (s)	27.2		31.3		32.2		36.3		36.3		36.3	
Approach LOS	C		C		C		D		D		D	
Intersection Summary												
HCM Average Control Delay	31.8			HCM Level of Service					C			
HCM Volume to Capacity ratio	0.66											
Actuated Cycle Length (s)	90.0			Sum of lost time (s)					12.0			
Intersection Capacity Utilization	62.6%			ICU Level of Service					B			
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
5: Main Street & Mountain Boulevard

Saturday Peak - Alternative 5
10/12/2010



















																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR								
Lane Configurations																				
Sign Control	Free			Free			Stop			Stop										
Grade	0%			0%			0%			0%										
Volume (veh/h)	30	1280	65	30	600	95	10	25	20	60	20	60								
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90								
Hourly flow rate (vph)	33	1422	72	33	667	106	11	28	22	67	22	67								
Pedestrians																				
Lane Width (ft)																				
Walking Speed (ft/s)																				
Percent Blockage																				
Right turn flare (veh)																				
Median type							None			None										
Median storage (veh)																				
Upstream signal (ft)																				
pX, platoon unblocked																				
vC, conflicting volume	772				1494				2003	2364	747	1600	2347	386						
vC1, stage 1 conf vol																				
vC2, stage 2 conf vol																				
vCu, unblocked vol	772				1494				2003	2364	747	1600	2347	386						
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5	6.5	6.9						
tC, 2 stage (s)																				
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5	4.0	3.3						
p0 queue free %	96				93				11	10	94	0	30	89						
cM capacity (veh/h)	839				445				13	31	355	14	32	612						
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1														
Volume Total	744	783	367	439	61	156														
Volume Left	33	0	33	0	11	67														
Volume Right	0	72	0	106	22	67														
cSH	839	1700	445	1700	33	28														
Volume to Capacity	0.04	0.46	0.07	0.26	1.85	5.64														
Queue Length 95th (ft)	3	0	6	0	171	Err														
Control Delay (s)	1.0	0.0	2.4	0.0	662.8	Err														
Lane LOS	A	A		F		F														
Approach Delay (s)	0.5	1.1			662.8	Err														
Approach LOS				F		F														
Intersection Summary																				
Average Delay	626.5																			
Intersection Capacity Utilization	80.4%				ICU Level of Service				D											
Analysis Period (min)	15																			

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
6: Main Street & Center Street

Saturday Peak - Alternative 5
10/12/2010




















																					
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR									
Lane Configurations																					
Sign Control	Free			Free			Stop			Stop											
Grade	0%			0%			0%			0%											
Volume (veh/h)	75	1025	0	95	40	695	45	10	95	40	0	35									
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90									
Hourly flow rate (vph)	83	1139	0	106	44	772	50	11	106	44	0	39									
Pedestrians																					
Lane Width (ft)																					
Walking Speed (ft/s)																					
Percent Blockage																					
Right turn flare (veh)																					
Median type							None			None											
Median storage (veh)																					
Upstream signal (ft)	1207																				
pX, platoon unblocked																					
vC, conflicting volume	817				1139				1578	2333	569	1489	1947	408							
vC1, stage 1 conf vol																					
vC2, stage 2 conf vol																					
vCu, unblocked vol	817				1139				1578	2333	569	1489	1947	408							
tC, single (s)	4.1				4.1				7.5	6.5	6.9	7.5	6.5	6.9							
tC, 2 stage (s)																					
tF (s)	2.2				2.2				3.5	4.0	3.3	3.5	4.0	3.3							
p0 queue free %	90				83				9	59	77	0	100	93							
cM capacity (veh/h)	807				609				55	27	465	37	47	592							
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1													
Volume Total	83	759	380	106	30	787	167	83													
Volume Left	83	0	0	106	0	0	50	44													
Volume Right	0	0	0	0	0	772	106	39													
cSH	807	1700	1700	609	1700	1700	108	65													
Volume to Capacity	0.10	0.45	0.22	0.17	0.02	0.46	1.55	1.28													
Queue Length 95th (ft)	9	0	0	16	0	0	310	171													
Control Delay (s)	10.0	0.0	0.0	12.1	0.0	0.0	357.4	311.5													
Lane LOS	A				B			F	F												
Approach Delay (s)	0.7				1.4			357.4	311.5												
Approach LOS							F			F											
Intersection Summary																					
Average Delay	36.6																				
Intersection Capacity Utilization	53.1%				ICU Level of Service				A												
Analysis Period (min)	15																				

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
7: Main Street & Forest Trail

Saturday Peak - Alternative 5
10/12/2010

																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR								
Lane Configurations																				
Sign Control	Free			Free			Stop			Stop										
Grade	0%			0%			0%			0%										
Volume (veh/h)	20	1140	20	15	700	70	20	0	20	140	5	35								
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90								
Hourly flow rate (vph)	22	1267	22	17	778	78	22	0	22	156	6	39								
Pedestrians																				
Lane Width (ft)																				
Walking Speed (ft/s)																				
Percent Blockage																				
Right turn flare (veh)												1								
Median type	None						None													
Median storage (veh)																				
Upstream signal (ft)	793																			
pX, platoon unblocked																				
vC, conflicting volume	856			1289			1747	2211	644	1550	2183	428								
vC1, stage 1 conf vol																				
vC2, stage 2 conf vol																				
vCu, unblocked vol	856			1289			1747	2211	644	1550	2183	428								
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9								
tC, 2 stage (s)																				
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3								
p0 queue free %	97			97			50	100	95	0	87	93								
cM capacity (veh/h)	780			534			44	41	415	70	43	575								
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1												
Volume Total	22	844	444	17	519	337	44	200												
Volume Left	22	0	0	17	0	0	22	156												
Volume Right	0	0	22	0	0	78	22	39												
cSH	780	1700	1700	534	1700	1700	80	83												
Volume to Capacity	0.03	0.50	0.26	0.03	0.31	0.20	0.56	2.42												
Queue Length 95th (ft)	2	0	0	2	0	0	61	467												
Control Delay (s)	9.7	0.0	0.0	12.0	0.0	0.0	96.4	755.4												
Lane LOS	A			B			F	F												
Approach Delay (s)	0.2			0.2			96.4	755.4												
Approach LOS							F	F												
Intersection Summary																				
Average Delay	64.2																			
Intersection Capacity Utilization	52.7%			ICU Level of Service				A												
Analysis Period (min)	15																			

HCM Unsignalized Intersection Capacity Analysis
8: Main Street & Laurel Mountain Road

Saturday Peak - Alternative 5
10/12/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↓		↵	↑↑	↵	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1000	0	165	20	95	30
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1111	0	183	22	106	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)			505			
pX, platoon unblocked						
vC, conflicting volume			1111		1489	556
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1111		1489	556
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			71		0	93
cM capacity (veh/h)			624		81	475
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	741	370	183	11	11	139
Volume Left	0	0	183	0	0	106
Volume Right	0	0	0	0	0	33
cSH	1700	1700	624	1700	1700	101
Volume to Capacity	0.44	0.22	0.29	0.01	0.01	1.37
Queue Length 95th (ft)	0	0	31	0	0	249
Control Delay (s)	0.0	0.0	13.1	0.0	0.0	294.9
Lane LOS			B			F
Approach Delay (s)	0.0		11.7			294.9
Approach LOS						F
Intersection Summary						
Average Delay	29.8					
Intersection Capacity Utilization	53.9%		ICU Level of Service			A
Analysis Period (min)	15					























HCM Signalized Intersection Capacity Analysis
9: Main Street & Old Mammoth Road

Saturday Peak - Alternative 5
10/12/2010

	→	↖	↗	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↘	↑↑	↘	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	1770	1583
Flt Permitted	1.00	1.00	0.37	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	690	3539	1770	1583
Volume (vph)	385	515	90	285	285	70
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	428	572	100	317	317	78
RTOR Reduction (vph)	0	397	0	0	0	47
Lane Group Flow (vph)	428	175	100	317	317	31
Turn Type	Perm		pm+pt	Perm		
Protected Phases	2	1		6	3	
Permitted Phases	2		6	3		
Actuated Green, G (s)	16.6	16.6	25.2	25.2	22.4	22.4
Effective Green, g (s)	17.5	17.5	26.1	26.1	23.0	23.0
Actuated g/C Ratio	0.31	0.31	0.46	0.46	0.40	0.40
Clearance Time (s)	4.9	4.9	4.1	4.9	4.6	4.6
Vehicle Extension (s)	5.2	5.2	2.5	5.2	5.2	5.2
Lane Grp Cap (vph)	1085	485	402	1618	713	638
v/s Ratio Prot	c0.12	c0.02		0.09	c0.18	
v/s Ratio Perm	0.11		0.09	0.02		
v/c Ratio	0.39	0.36	0.25	0.20	0.44	0.05
Uniform Delay, d1	15.6	15.4	9.2	9.2	12.4	10.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.0	0.2	0.1	2.0	0.1
Delay (s)	16.2	16.5	9.5	9.4	14.4	10.5
Level of Service	B	B	A	A	B	B
Approach Delay (s)	16.3			9.4	13.6	
Approach LOS	B			A	B	
Intersection Summary						
HCM Average Control Delay	14.2		HCM Level of Service		B	
HCM Volume to Capacity ratio	0.41					
Actuated Cycle Length (s)	57.1		Sum of lost time (s)		12.0	
Intersection Capacity Utilization	43.6%		ICU Level of Service		A	
Analysis Period (min)	15					
c Critical Lane Group						


















HCM Unsignalized Intersection Capacity Analysis
10: Main Street & Sierra Park Boulevard

Saturday Peak - Alternative 5
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	10	375	85	40	310	10	40	10	50	10	10	15
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	417	94	44	344	11	44	11	56	11	11	17
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)	544											
pX, platoon unblocked				0.94			0.94			0.94	0.94	0.94
vC, conflicting volume	356				511		769		931	256	731	972
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	356				422		696		866	151	654	911
tC, single (s)	4.1				4.1		7.5		6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2				2.2		3.5		4.0	3.3	3.5	4.0
p0 queue free %	99				96		84		96	93	96	95
cM capacity (veh/h)	1200				1070		282		259	819	288	244
	835											
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1		SB 1			
Volume Total	11	278	233	44	230	126	111		39			
Volume Left	11	0	0	44	0	0	44		11			
Volume Right	0	0	94	0	0	11	56		17			
cSH	1200	1700	1700	1070	1700	1700	414		374			
Volume to Capacity	0.01	0.16	0.14	0.04	0.14	0.07	0.27		0.10			
Queue Length 95th (ft)	1	0	0	3	0	0	27		9			
Control Delay (s)	8.0	0.0	0.0	8.5	0.0	0.0	16.9		15.7			
Lane LOS	A			A			C		C			
Approach Delay (s)	0.2				0.9		16.9		15.7			
Approach LOS							C		C			
Intersection Summary												
Average Delay				2.8								
Intersection Capacity Utilization	35.3%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
11: Tavern Road & Old Mammoth Road

Saturday Peak - Alternative 5
10/12/2010

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop		Free				Free	
Grade	0%				0%		0%				0%	
Volume (veh/h)	20	5	40	5	5	15	50	400	5	10	710	40
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	6	44	6	6	17	56	444	6	11	789	44
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	760											
pX, platoon unblocked												
vC, conflicting volume	1408	1394	811	1417	1414	447	833	450				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1408	1394	811	1417	1414	447	833	450				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	78	96	88	94	96	97	93	99				
cM capacity (veh/h)	103	130	379	92	127	611	800	1110				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	72	28	56	450	11	833						
Volume Left	22	6	56	0	11	0						
Volume Right	44	17	0	6	0	44						
cSH	192	211	800	1700	1110	1700						
Volume to Capacity	0.38	0.13	0.07	0.26	0.01	0.49						
Queue Length 95th (ft)	41	11	6	0	1	0						
Control Delay (s)	34.6	24.6	9.8	0.0	8.3	0.0						
Lane LOS	D	C	A		A							
Approach Delay (s)	34.6	24.6	1.1		0.1							
Approach LOS	D	C										
Intersection Summary												
Average Delay	2.6											
Intersection Capacity Utilization	54.3%		ICU Level of Service				A					
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
12: Sierra Nevada Road & Old Mammoth Road

Saturday Peak - Alternative 5
10/12/2010










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	20	15	85	20	20	35	75	430	5	45	660	45
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	17	94	22	22	39	83	478	6	50	733	50
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	773											
pX, platoon unblocked	0.98	0.98		0.98	0.98	0.98				0.98		
vC, conflicting volume	1553	1508	758	1583	1531	481	783				483	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1566	1521	758	1598	1544	468	783				471	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	63	83	77	56	77	93	90				95	
cM capacity (veh/h)	60	99	407	50	96	581	835				1065	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	133	83	83	483	50	783						
Volume Left	22	22	83	0	50	0						
Volume Right	94	39	0	6	0	50						
cSH	174	112	835	1700	1065	1700						
Volume to Capacity	0.77	0.74	0.10	0.28	0.05	0.46						
Queue Length 95th (ft)	125	102	8	0	4	0						
Control Delay (s)	73.0	97.7	9.8	0.0	8.5	0.0						
Lane LOS	F	F	A		A							
Approach Delay (s)	73.0	97.7	1.4		0.5							
Approach LOS	F	F										
Intersection Summary												
Average Delay	11.8											
Intersection Capacity Utilization	60.0%			ICU Level of Service					B			
Analysis Period (min)	15											

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Unsignalized Intersection Capacity Analysis
13: Meridian Boulevard & Majestic Pines Drive

Saturday Peak - Alternative 5
10/12/2010

























						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	60	425	210	70	50	40
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	67	472	233	78	56	44
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	311				642	156
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	311				642	156
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				86	95
cM capacity (veh/h)	1246				385	862
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	224	315	156	156	100	
Volume Left	67	0	0	0	56	
Volume Right	0	0	0	78	44	
cSH	1246	1700	1700	1700	511	
Volume to Capacity	0.05	0.19	0.09	0.09	0.20	
Queue Length 95th (ft)	4	0	0	0	18	
Control Delay (s)	2.7	0.0	0.0	0.0	13.8	
Lane LOS	A				B	
Approach Delay (s)	1.1		0.0		13.8	
Approach LOS					B	
Intersection Summary						
Average Delay	2.1					
Intersection Capacity Utilization	36.8%		ICU Level of Service		A	
Analysis Period (min)	15					

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Unsignalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis
14: Meridian Boulevard & Minaret Road

Saturday Peak - Alternative 5
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.94		1.00	0.98		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3417		1770	3313		1770	1828		1770	1816	
Flt Permitted	0.34	1.00		0.47	1.00		0.37	1.00		0.44	1.00	
Satd. Flow (perm)	635	3417		881	3313		688	1828		816	1816	
Volume (vph)	140	320	95	30	195	145	50	180	25	315	420	85
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	156	356	106	33	217	161	56	200	28	350	467	94
RTOR Reduction (vph)	0	29	0	0	126	0	0	6	0	0	8	0
Lane Group Flow (vph)	156	433	0	33	252	0	56	222	0	350	553	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	25.4	19.5		17.4	15.5		24.4	21.3		39.2	32.0	
Effective Green, g (s)	26.4	20.4		18.4	16.4		25.4	22.2		40.1	32.9	
Actuated g/C Ratio	0.35	0.27		0.25	0.22		0.34	0.30		0.54	0.44	
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9		4.1	4.9	
Vehicle Extension (s)	2.5	5.0		2.5	5.0		2.5	5.0		2.5	5.0	
Lane Grp Cap (vph)	316	936		241	729		281	545		617	802	
v/s Ratio Prot	c0.04	0.13		0.00	0.08		0.01	0.12		c0.11	c0.30	
v/s Ratio Perm	c0.14			0.03			0.06			0.20		
v/c Ratio	0.49	0.46		0.14	0.35		0.20	0.41		0.57	0.69	
Uniform Delay, d1	17.4	22.5		21.5	24.5		16.8	20.9		10.5	16.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.9	0.8		0.2	0.6		0.3	1.0		1.0	3.2	
Delay (s)	18.3	23.3		21.7	25.1		17.1	21.9		11.4	19.9	
Level of Service	B	C		C	C		B	C		B	B	
Approach Delay (s)	22.0			24.9			21.0			16.6		
Approach LOS	C			C			C			B		
Intersection Summary												
HCM Average Control Delay	20.2		HCM Level of Service		C							
HCM Volume to Capacity ratio	0.61											
Actuated Cycle Length (s)	74.5		Sum of lost time (s)		12.0							
Intersection Capacity Utilization	63.4%		ICU Level of Service		B							
Analysis Period (min)	15											
c Critical Lane Group												

LSC, Inc. (BP)
Mammoth Lakes (LSC#084870)
LSC, Inc.

HCM Signalized Intersection Capacity Analysis
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HCM Signalized Intersection Capacity Analysis
15: Meridian Boulevard & Old Mammoth Road

Saturday Peak - Alternative 5
10/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.97		1.00	1.00		0.85	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3458		1770	3445		1770	1863		1583	1770	1863
Flt Permitted	0.34	1.00		0.17	1.00		0.27	1.00		0.45	1.00	1.00
Satd. Flow (perm)	632	3458		315	3445		511	1863		1583	839	1863
Volume (vph)	190	690	125	105	370	80	140	255	55	125	340	60
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	211	767	139	117	411	89	156	283	61	139	378	67
RTOR Reduction (vph)	0	17	0	0	20	0	0	0	43	0	0	48
Lane Group Flow (vph)	211	889	0	117	480	0	156	283	18	139	378	19
Turn Type	pm+pt			pm+pt			pm+pt		Perm	pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	33.2	25.4		28.2	22.9		27.0	21.5	21.5	25.4	20.7	20.7
Effective Green, g (s)	34.2	26.3		29.2	23.8		28.0	22.4	22.4	26.4	21.6	21.6
Actuated g/C Ratio	0.46	0.35		0.39	0.32		0.37	0.30	0.30	0.35	0.29	0.29
Clearance Time (s)	4.1	4.9		4.1	4.9		4.1	4.9	4.9	4.1	4.9	4.9
Vehicle Extension (s)	2.5	3.7		2.5	3.8		2.5	3.8	3.8	2.5	3.8	3.8
Lane Grp Cap (vph)	409	1214		228	1095		285	557	473	355	537	457
v/s Ratio Prot	c0.05	c0.26		0.04	0.14		c0.04	0.15		0.03	c0.20	
v/s Ratio Perm	0.18			0.16			0.16		0.01	0.11		0.01
v/c Ratio	0.52	0.73		0.51	0.44		0.55	0.51	0.04	0.39	0.70	0.04
Uniform Delay, d1	13.0	21.2		15.9	20.3		17.1	21.7	18.6	17.2	23.8	19.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	2.4		1.5	0.4		1.7	0.9	0.0	0.5	4.4	0.0
Delay (s)	13.8	23.7		17.4	20.6		18.8	22.6	18.7	17.8	28.2	19.2
Level of Service	B	C		B	C		B	C	B	B	C	B
Approach Delay (s)		21.8			20.0			20.9			24.7	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM Average Control Delay		21.9			HCM Level of Service			C				
HCM Volume to Capacity ratio		0.71										
Actuated Cycle Length (s)		74.9			Sum of lost time (s)			16.0				
Intersection Capacity Utilization		67.9%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												


















HCM Unsignalized Intersection Capacity Analysis
16: Meridian Boulevard & Sierra Park Road

Saturday Peak - Alternative 5
10/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	45	145	5	5	140	15	25	5	5	15	5	75
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	50	161	6	6	156	17	28	6	6	17	6	83
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total (vph)	131	86	83	94	39	106						
Volume Left (vph)	50	0	6	0	28	17						
Volume Right (vph)	0	6	0	17	6	83						
Hadj (s)	0.23	-0.01	0.07	-0.09	0.09	-0.41						
Departure Headway (s)	5.2	5.0	5.1	5.0	5.0	4.5						
Degree Utilization, x	0.19	0.12	0.12	0.13	0.05	0.13						
Capacity (veh/h)	666	692	671	695	659	744						
Control Delay (s)	8.3	7.5	7.6	7.5	8.3	8.1						
Approach Delay (s)	8.0		7.6		8.3	8.1						
Approach LOS	A		A		A	A						
Intersection Summary												
Delay		7.9										
HCM Level of Service		A										
Intersection Capacity Utilization		26.5%			ICU Level of Service					A		
Analysis Period (min)		15										





















HCM Unsignalized Intersection Capacity Analysis
17: Chateau Road & Old Mammoth Road

Saturday Peak - Alternative 5
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop				Stop		Free				Free	
Grade	0%				0%		0%				0%	
Volume (veh/h)	30	35	10	10	20	60	10	300	10	105	365	75
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	33	39	11	11	22	67	11	333	11	117	406	83
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)												1037
pX, platoon unblocked	0.98	0.98	0.98	0.98	0.98	0.98						
vC, conflicting volume	1114	1047	447	1031	1083	339	489	344				
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1116	1048	435	1031	1085	339	478	344				
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1	4.1				
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2	2.2				
p0 queue free %	76	80	98	93	88	91	99	90				
cM capacity (veh/h)	137	199	608	159	190	703	1061	1215				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	83	100	11	344	117	489						
Volume Left	33	11	11	0	117	0						
Volume Right	11	67	0	11	0	83						
cSH	183	355	1061	1700	1215	1700						
Volume to Capacity	0.46	0.28	0.01	0.20	0.10	0.29						
Queue Length 95th (ft)	54	28	1	0	8	0						
Control Delay (s)	40.3	19.1	8.4	0.0	8.3	0.0						
Lane LOS	E	C	A		A							
Approach Delay (s)	40.3	19.1	0.3	1.6								
Approach LOS	E	C										
Intersection Summary												
Average Delay	5.5											
Intersection Capacity Utilization	47.6%			ICU Level of Service				A				
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
18: Old Mammoth Road & Minaret Road

Saturday Peak - Alternative 5
10/12/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	105	170	40	125	195	90	20	65	85	100	145	190
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	117	189	44	139	217	100	22	72	94	111	161	211
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type									None	None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	317			233			1231	1039	211	1050	1011	267
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	317			233			1231	1039	211	1050	1011	267
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	91			90			27	61	89	0	17	73
cM capacity (veh/h)	1243			1334			30	187	829	110	194	772
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	117	233	139	317	189	111	372					
Volume Left	117	0	139	0	22	111	0					
Volume Right	0	44	0	100	94	0	211					
cSH	1243	1700	1334	1700	251	110	338					
Volume to Capacity	0.09	0.14	0.10	0.19	0.75	1.01	1.10					
Queue Length 95th (ft)	8	0	9	0	134	163	354					
Control Delay (s)	8.2	0.0	8.0	0.0	52.7	161.9	114.9					
Lane LOS	A		A		F	F	F					
Approach Delay (s)	2.7	2.4		52.7		125.7						
Approach LOS				F		F						
Intersection Summary												
Average Delay	49.3											
Intersection Capacity Utilization	52.4%			ICU Level of Service					A			
Analysis Period (min)	15											

Town of Mammoth Lakes Travel Demand Model Description of Model Design Volume Methodology

The following is an excerpt from the General Plan Final Environmental Impact Report (FEIR) Volume II: Response to Comments (Responses 11-209, 11-210, and 11-212) that describes the travel model design volume development and the rationale for the use of the “typical winter Saturday” peak-hour conditions as a basis for analyzing traffic impacts and Level of Service (LOS) in the Town of Mammoth Lakes.

Typical Winter Saturday Peak-Hour

To avoid the development or expansion of facilities that are needed only a relatively few days per year, or hours per year, it is standard practice to use a design volume level that is slightly less than the absolute peak traffic volume. In order to accomplish this, the Town of Mammoth Lakes uses the concept of the “typical winter Saturday peak hour” as the basis for the design of facilities. While daily traffic volumes in Mammoth Lakes are sometimes the highest in the summer months, the highest peak-hour volumes are typically experienced on winter Saturdays, during the afternoon hours when skiers “download” from the Mammoth Mountain Ski Area.

The Town of Mammoth Lakes General Plan Transportation Element currently contains the following Policy:

“Policy 1.7: Establish and maintain a Level of Service D or better on a typical winter Saturday peak-hour for signalized intersections and for primary through movements for unsignalized intersections along arterial and collector roads. This standard is expressly not applied to absolute peak conditions, as it would result in construction of roadway improvements that are warranted only a limited number of days per year and that would unduly impact pedestrian and visual conditions.”

The LOS thresholds utilized in the General Plan FEIR are defined in terms of delay and are as follows:

1. For Signalized Intersections: Total intersection LOS D or better must be maintained. Therefore, if a signalized intersection is found to operate at a total intersection LOS E or F, mitigation is required. This same threshold was applied to roundabouts.
2. For Unsignalized Intersections: In order to avoid the identification of a LOS failure for intersections that result in only a few vehicles experiencing a delay greater than 50 seconds (such as at a driveway serving a few homes that accesses onto a busy street), a LOS deficiency is not identified for all intersections which approach LOS E or F. Instead, a LOS deficiency is assumed to occur at an unsignalized intersection only if an individual local street movement operates at LOS E or F and total minor approach delay exceeds 4 vehicle hours for a single lane approach and 5 vehicle hours for a multilane approach. In other words, a

deficiency is found to occur if the average number of vehicles queued over the peak-hour exceeds 4 at a single lane approach, or exceeds 5 at a multilane approach. A vehicle hour is calculated by multiplying the average delay per vehicle during the peak hour by the number of vehicles experiencing that delay. For example, if 100 vehicles exit a roadway and experience an average delay of 20 seconds per vehicle, the vehicle hours of delay for that approach would be 0.6 vehicle hours (100 vehicles X 20 seconds of delay per vehicle / 3600 seconds per hour). Therefore, this threshold not only considers the average delay per vehicle, but also considers how many vehicles experience the delay. As the Town has adopted a standard that applies the LOS D threshold to a typical winter Saturday standard, the exceedance of LOS D on peak winter days during which traffic volumes are higher than the typical winter Saturday would not result in a significant LOS impact. This is typically done to avoid the need to build facilities that are only needed a few hours per year. Areas with uses that have typical peak hours not on Saturday shall be analyzed for the mid-week peak hours.

According to *A Policy on Geometric Design of Highways and Streets* (American Association of State Highway and Transportation Officials, 2004):

“There are roadways for which there are unusual or highly seasonal fluctuations in traffic flow, such as resort roads on which weekend traffic during a few months of the year far exceeds the traffic during the rest of the year. [For such roads], a design that results in somewhat less satisfactory traffic operation during seasonal periods than on rural roads with normal traffic fluctuations, will generally be acceptable to the public. On the other hand, design should not be so economical that severe congestion results during the peak hours. It may be desirable, therefore, to choose an hourly volume for design, which is about 50 percent of the volumes expected to occur during a few highest hours of the design year...”

Applying LOS thresholds to a typical winter Saturday, which result in traffic volumes that are roughly 86 percent of the peak day traffic volumes, is a far more conservative approach than suggested by the *American Association of State Highway and Transportation Officials* in this nationally recognized document. In addition, the level of improvements that would be required by more restrictive LOS standards (such as those based upon a peak day analysis) would result in wider roads, more pavement, and would not fit within the existing character of the Town. Not only would these improvements create a more urban environment, but wider roads make for a less pedestrian friendly environment.

Regardless, a limited quantitative evaluation of peak traffic days is provided here. As discussed below, the Town of Mammoth Lakes’ use of a typical winter Saturday is consistent with but more conservative (i.e., results in higher design volumes) than the 30th highest hour design period recommended by the American Association of State Highway and Transportation Officials. Figure 1, Daily Variation in Traffic Volumes

Along Main Street East of Minaret, in the Mammoth Lakes Transportation Model and LOS Analysis Methodology Paper, prepared by LSC Transportation Consultants, dated May 13, 2005, depicts the variation of traffic volumes along Main Street east of Minaret by day of the week. The Background Paper is contained in Appendix F, Traffic Study, of the Revised Draft Program EIR. As Figure 1 indicates, Saturdays consistently represent the day during which the peak traffic conditions occur. However, on some holiday weekends high traffic volumes may occur on days other than Saturday. For example, as shown in Table 3, 2003/2004 Winter Daily Traffic Volumes Along Main Street East of Minaret Sorted Highest to Lowest, of the Background Paper, the highest traffic volumes usually occur around the Christmas, New Years, President's Day, and Martin Luther King Jr. holidays. Figure 2, Peak-Hour Traffic Volumes Main Street East of Minaret (March 6, 2004), in the Background Paper presents the hourly traffic volume variation along Main Street east of Minaret Road on the day in the 2003/2004 winter season which most closely reflects the design day traffic volume. As Figure 2 indicates, the P.M. peak-hour traffic volumes are usually significantly higher than the A.M. peak-hour traffic volumes. This is mostly attributed to the fact that skiers generally leave the ski area during a smaller time period than they arrive. Therefore, it can be concluded that designing for the P.M. peak hour is appropriate.

According to 2003 peak-hour count data provided by Caltrans, some summer days also result in very high traffic volumes throughout Mammoth Lakes. The following summer days ranked within the 30 highest peak-hour traffic volume days along Main Street East of Minaret Road:

- July 5, 2003 (three peak hours: 12:00 P.M., 2:00 P.M., and 4:00 P.M.)
- August 8, 2003 (two peak hours: 11:00 A.M. and 4:00 P.M.)
- August 15, 2003 (4:00 P.M.)
- August 30, 2003 (two peak hours: 11:00 A.M. and 12:00 P.M.)

However, in general, peak hour traffic volumes are generally highest townwide during the winter season. It is assumed that approximately ten of the 30 highest peak-hour volumes throughout the year on Main Street in Mammoth Lakes occur during the summer, which is a conservative estimate based upon the eight peak hours identified above. It is also assumed that during the winter the P.M. peak-hour traffic volumes are significantly higher than any other hour of the day. Referring to Table 2 and Figure 3, Daily Traffic Volumes along Main Street East of Minaret, in the Background Paper, it can be seen that the design day roughly represents the day during which the 16th highest winter peak-hour traffic volumes occur. Taking into account summer traffic volumes, the design day roughly represents the day during which the 26th highest peak-hour traffic volumes occur, which is more conservative (i.e., results in higher design volumes) than the 30th highest hour design period recommended by the *American Association of State Highway and Transportation Officials*.

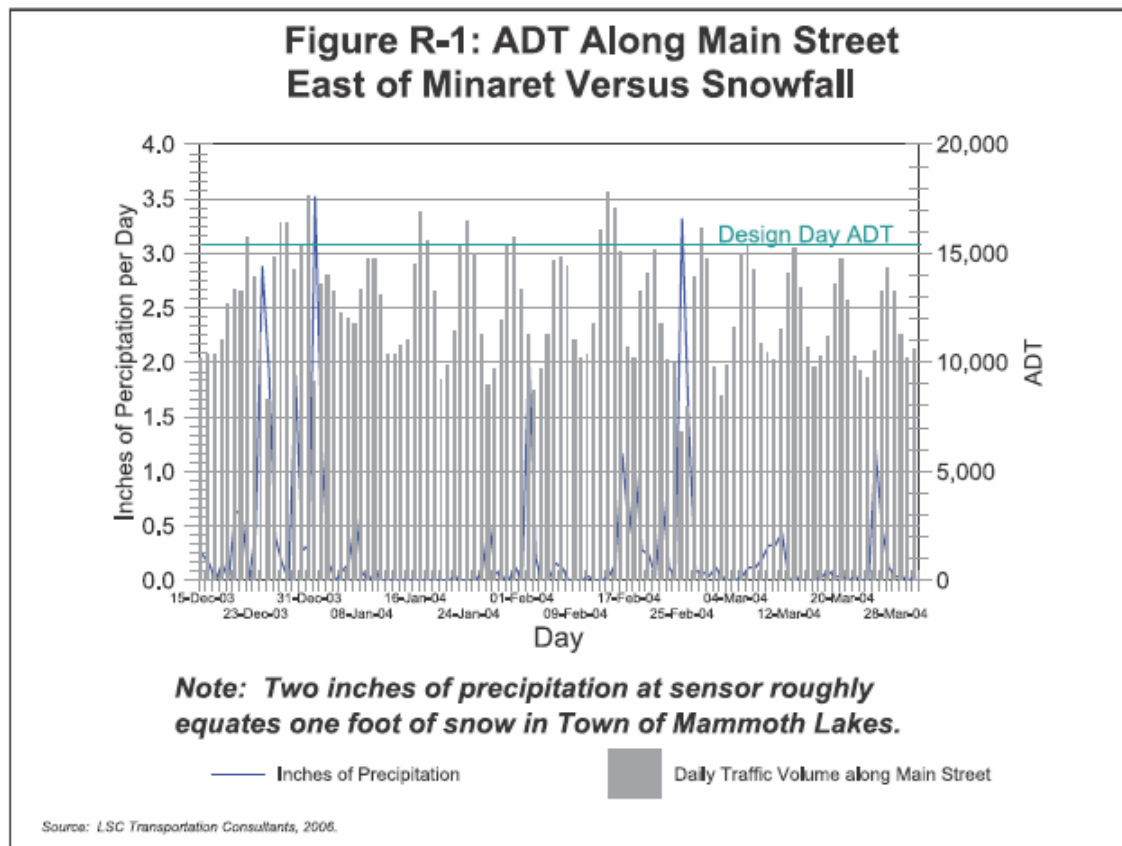
During these approximately 25 highest hours per year, the design day traffic volumes are exceeded, and LOS may drop below the Town standards. These 25 hours represent 0.3 percent of the hours in a year. Therefore, although the capacity of the roadway may be exceeded for 0.3 percent of the time during the year, traffic volumes will be accommodated by the roadway capacity 99.7 percent of the time.

In order to demonstrate traffic conditions that might occur during the 25 hours that result in higher traffic volumes than the design day, some additional LOS analyses were conducted. Referring to Table 2 in the Background Paper, the peak day winter average daily traffic (ADT) is approximately 16 percent higher than the design day ADT. Assuming a similar relationship occurs between the peak hours at all study intersection, it was estimated that on the peak day the peak-hour volume was 16 percent higher than the design day peak-hour volume. Intersection LOS was re-run for the traffic volumes that were 16 percent higher than those generated by the Draft General Plan Update during the design day peak-hour. The results of the analysis indicate that the implementation of the intersection LOS mitigation measures would result in adequate LOS (LOS D or better) at all intersections in the study area under the winter highest peak-hour conditions, with the exception of the US 395/Main Street, Meridian Boulevard/Majestic Pines, Minaret Road/Old Mammoth Road, and US 395 Northbound/Hot Creek Hatchery Road intersections, which would fail under peak conditions. However, these conditions would likely occur for no more than 26 hours per year, or 0.3 percent of the total year.

Also, consistent with standard analysis procedures applied in other high snowfall communities, such as Lake Tahoe and the Town of Truckee, LOS and capacity were not adjusted to account for snow conditions. The occurrence of stormy/snowy weather conditions and snow on the roadways actually occurs over a relatively small proportion of the winter. Furthermore, as traffic capacity varies with the specific conditions of a storm, as well as "incidences" such as drivers stopping in travel lanes to adjust chains, identifying a "design condition" to reflect winter storms would largely be speculative. In accordance with Section 15145 in the CEQA Guidelines, if a thorough investigation is unable to resolve an issue and the answer remains purely speculative, then the discussion of the effects of the issue should be terminated. Consistent with Section 15145, since it would be too speculative to analyze the effects of high traffic volumes during heavy snowfall periods, additional design analysis during such conditions is not appropriate. In addition, this approach is consistent with other traffic analyses that LSC has prepared in areas with high annual snowfall, such as the Lake Tahoe region, Park City, Utah, and Aspen, Colorado.

Regardless, Figure 1 on the following page (Figure 11 on page 5 of the GPFEIR: Volume II), illustrates the provides an analysis of the correlation between traffic volumes along Main Street east of Minaret Road and precipitation at Mammoth Pass as reported by the California Department of Water Resources.

Figure 1 ADT along Main Street East of Minaret Versus Snowfall



As the figure indicates, for all the winter days that the Average Daily Traffic (ADT) along Main Street was higher than the design day ADT, the inches of precipitation on Mammoth Pass was less than 0.32 inches, which equates to approximately two inches of snow.¹ In addition, during the top five snow days, the daily traffic volumes along Main Street were at least 26 percent less than those occurring on the design day. Although it cannot be concluded from this data that high traffic volumes will never occur during days when there is heavy snowfall, it can be concluded that such an event would be rare and it is not appropriate to design for such conditions.

¹ Peter Bernasconi, Town of Mammoth Lakes Associate Civil Engineer, two inches of precipitation at the weather station at Mammoth Pass equates to approximately one foot of snow in the Town of Mammoth Lakes.

Mammoth Lakes Transportation Model and LOS Analysis Methodology Background Paper

LSC Transportation Consultants, Inc.
May 13, 2005

This paper is intended to provide a concise summary of the procedures and assumptions used in evaluating traffic conditions in Mammoth Lakes, specifically for the General Plan update and Capital Improvement Programs. First, a general discussion of Level Of Service (LOS) concepts is presented as applied in Mammoth Lakes, followed by a discussion of the transportation modeling process.

LEVEL OF SERVICE

Definition of LOS

The concept of level of service is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level-of-service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. Six levels of service are defined for each type of roadway facility. They are given letter designations, from A to F, with Level of Service A representing the best operating conditions and Level of Service F the worst.

In general, the various levels of service are defined as follows for roadways (away from intersections):

- **Level of Service A** represents free flow. Individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.
- **Level of Service B** is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behavior.
- **Level of Service C** is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual drivers becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.
- **Level of Service D** represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

- **Level of Service E** represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.
- **Level of Service F** is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level of Service F is used to describe the operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases operating conditions of vehicles or pedestrians discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge flow which causes the queue to form, and Level of Service F is an appropriate designation for such points.

The LOS resulting from different levels of vehicle control delay, as identified in the Highway Capacity Manual, are shown in Table 1. Control delay is the total time that elapses between the vehicle joining the queue and its departure from the head of the queue plus the time required to decelerate to a stop and to accelerate to free-flow speed. The delays identified in the table relate the perception of the driver in the amount they are delayed at an intersection to LOS.

LOS Standards

The Town of Mammoth Lakes General Plan Transportation Element, adopted in 2001, currently contains the following Policy:

Policy 1.7: *Establish and maintain a Level of Service D or better on a typical winter Saturday peak-hour for signalized intersections and for primary through movements for unsignalized intersections along arterial and collector roads. This standard is expressly not applied to absolute peak conditions, as it would result in construction of roadway improvements that are warranted only a limited number of days per year and that would unduly impact pedestrian and visual conditions.*

Therefore, the following LOS thresholds were applied in the General Plan traffic analysis:

1. *For Signalized Intersections:* Total intersection LOS D or better must be maintained. Therefore, if a signalized intersection is found to operate at a total intersection LOS E or F, mitigation is required. It is assumed that this same threshold applies to roundabouts.
2. *For Unsignalized Intersections:* In order to avoid intersection the identification of a LOS failure for intersections that result in only a few vehicles experience a delay greater than 50 seconds (such as at a driveway serving a few homes that accesses onto a busy street), a LOS deficiency is not identified for all intersections with approach LOS E or F. Instead, a LOS deficiency is assumed to occur at an unsignalized intersection only if an individual minor street movement operates at LOS E or F and total minor approach delay exceeds 4

vehicle hours for a single lane approach and 5 vehicle hours for a multi lane approach. In other words, a deficiency is found to occur if the average number of vehicles queued over the peak-hour exceeds 4 at a single lane approach, or exceeds 5 at a multilane approach.

Comparison with Other Jurisdiction LOS Standards

As shown in Table 2, Mammoth Lakes LOS policy is in line with many jurisdictions within California. Some more rural areas (such have Amador and Siskiyou Counties) have a "higher" LOS C standard, while other areas have a lower LOS E standard in some areas. The Town of Mammoth Lakes is probably most comparable to the Town of Truckee in its population and its high level of tourist visitation during both the summer and winter: Mammoth Lake's LOS D thresholds are more stringent than the Town of Truckee's in that a LOS E is permitted in the Truckee downtown area.

Impacts Associated with a More Restrictive (Higher) LOS

In considering an appropriate LOS standard, it is useful to identify how changing the standard would impact the need for roadway improvements (with the attendant impacts on community character). The impact of the Town changing their LOS policy to a more restrictive (higher) LOS would be that more intersections and roadways would require improvements by 2025, and those already identified as needing improvements by 2025 would require improvements sooner. For comparison purposes, assume the Town adopted a LOS B standard. The following intersections, which are currently identified to operate at adequate LOS under 2004 conditions, would need to be expanded to attain a LOS B standard:

- Lakeview Road/Lake Mary Road
- Minaret Road/Main Street
- Old Mammoth Road/Main Street
- US 395 Northbound/Main Street (SR 203)
- Minaret Road/Old Mammoth Road
- Minaret Road/Meridian Road

In addition, the following intersections, which are currently forecast to operate at adequate LOS by 2025, would need to be expanded to attain a LOS B standard:

- Old Mammoth Road/Main Street
- Sierra Park Road/Main Street
- US 395 Northbound/Main Street (SR 203)
- Old Mammoth Road/Meridian Boulevard
- US 395 Southbound/Hot Creek Fish Hatchery Road

As for those intersections that have already been identified as requiring mitigation by 2025, additional improvements would be required to maintain a LOS B over the next 20 years. For example, the Minaret Road/Main Street intersection would need the following additional lanes by 2024 if the LOS B standard were adopted:

- Northbound Approach: Add Second Through Lane.
- Southbound Approach: Add Two Through Lanes and Separate Right-Turn Lane and Remove Shared Through/Right Lane.

- Eastbound Approach: Add Second Left-Turn Lane and Second Through Lane.
- Westbound Approach: Add Second Left-Turn Lane and Second Through Lane.

In total, Main Street through this intersection would need to be expanded by one through lane in each direction, and Minaret Road expanded by one through lane in each direction.

As another example, the Minaret Road/Meridian Boulevard intersection would need the following additional lanes by 2024 if the LOS B standard were adopted:

- Northbound Approach: Add Two Through Lanes and a Separate Right-Turn Lane and Remove Through/Right Shared Lane.
- Southbound Approach: Add Two Through Lanes and a Separate Right-Turn Lane and Remove Through/Right Shared Lane.
- Eastbound Approach: Add Second Left-Turn Lane, Second Through Lane, Separate Right-Turn Lane and Remove Through/Right Shared Lane.
- Westbound Approach: Add Second Through Lane, Separate Right-Turn Lane and Remove Through/Right Shared Lane.

This would add a total of one through lane in each direction on Minaret Road. Furthermore, Minaret Road through the Village area would need to be widened to a total of four lanes (two lanes in each direction).

The level of improvements that would be required by more restrictive LOS standards would result in wider roads, more pavement, and would not fit within the existing character of the Town. Not only would these improvements create an urban environment, but wider roads make for a less pedestrian-friendly environment. The substantial impacts of roadway improvements needed to attain a high LOS is the reason why the majority of urban and resort communities have adopted LOS standards at or near D.

TRAFFIC MODEL

Model Design Day

A crucial step in development of a traffic model is collecting and refining a comprehensive set of existing design volumes. The existing Town of Mammoth Lakes Transportation Demand Model is based upon a typical winter Saturday P.M. peak-hour design period, defined as the average winter Saturday peak hour. The traffic volumes throughout the Town of Mammoth Lakes vary greatly by time of day, day of week and, more importantly, by season. Particularly in areas with these high variation in traffic levels, it is important to decide what hourly traffic volumes should be used as the basis of design.

To avoid the development of facilities that are only needed a relatively few days per year, the traffic engineering profession has adopted a standard procedure of basing roadway design on volumes slightly below the absolute peak volumes. For this reason the Town of Mammoth Lakes, for example, has focused most of its design policies on a typical Winter Saturday peak hour, rather than the highest winter peak hour. A Policy on Geometric Design of Highways and Streets (American Association of State Highway and Transportation Officials, 2001) indicates "The design hourly volume for rural highways ... should generally be the 30th highest volume of the future year chosen for design." (P 61). It is true that during winter peak periods, traffic volumes

occasionally exceed the intersection and roadway capacity. However, to avoid the development of facilities that are only needed a relatively few days per year, the typical winter Saturday peak hour was analyzed, which is consistent with standard engineering design practice.

The use of a 10th or 30th highest design hour is common practice in many resort communities. For example, in the Town of Truckee the 10th highest summer peak hour is used. In addition, in Truckee, peak ski traffic volumes occurring during the winter are not designed for at all. In Placer County, the winter design day represents the 30th highest winter peak hour. As part of a recent traffic analysis prepared for the development of Kings Beach, the 10th highest summer peak hour was used, which was determined appropriate by Caltrans, Placer County, and the Tahoe Regional Planning Agency.

Figure 1 depicts the variation of traffic volumes along Main Street east of Minaret by day of the week. As the figure indicates, Saturdays consistently represent the day during which the peak traffic conditions occur. Of course, on some holiday weekends high traffic volumes may occur on days other than Saturday. As shown in Table 3, for example, the highest traffic volumes usually occur around the Christmas, New Years, President's Day, and Martin Luther King Jr. holidays. Figure 2 presents the hourly traffic volume variation along Main Street east of Minaret Road on the day in the 2003/2004 winter season which most closely reflects the design day traffic volume. As the figure indicates, the P.M. peak-hour traffic volumes are usually significantly higher than the A.M. peak-hour traffic volumes. This is mostly attributed to the fact that skiers generally leave the ski area during a smaller time frame than they arrive. Therefore, it can be concluded that designing for the P.M. peak hour is appropriate.

According to 2003 peak-hour count data provided by Caltrans, some summer days also result in very high traffic volumes throughout Mammoth Lakes. In fact, the following days ranked within the 30 highest peak-hour traffic volume days along Main Street East of Minaret Road:

- July 5, 2003 (three peak hours: 12:00 P.M., 2:00 P.M., and 4:00 P.M.)
- August 8, 2003 (two peak hours: 11:00 A.M. and 4:00 P.M.)
- August 15, 2003 (4:00 P.M.)
- August 30, 2003 (two peak hours: 11:00 A.M. and 12:00 P.M.)

However, in general, traffic volumes are generally highest Townwide during the winter season.

It can be assumed that approximately 10 of the highest peak-hour volumes on Main Street in Mammoth Lakes occur during the summer. It is also assumed that during the winter the P.M. peak-hour traffic volume is significantly higher than any other hour of the day. Referring to Table 3 and Figure 3, it can be seen that the design day roughly represents the day during which the 16th highest winter peak-hour traffic volumes occur. Taking into account summer traffic volumes, the design day roughly represents the day during which the 26th highest peak-hour traffic volumes occur. Therefore, the Town of Mammoth Lakes' use of a typical winter Saturday is consistent with but more conservative (i.e., results in higher design volumes) than AASHTO's recommended 30th highest hour.

In addition, it can be said that during approximately 25 hours per year, the design day traffic volumes are exceeded, and LOS may drop below the Town standards. These 25 hours represent 0.3 percent of the hours in a year. Therefore, although the capacity of the roadway may be

exceeded for 0.3 percent of the time during the year, traffic volumes will be accommodated by the roadway capacity 99.7 percent of the time.

It should also be noted that, consistent with standard analysis procedures elsewhere, Level of Service and capacity was not adjusted to account for snow conditions. The occurrence of stormy/snowy weather conditions and snow on the roadways actually occurs over a relatively small proportion of the winter (though the last winter might make it seem otherwise). Furthermore, as traffic capacity varies with the specific conditions of a storm as well as "incidences" such as drivers stopping in travel lanes to adjust chains, identifying a "design condition" to reflect winter storms would largely be conjecture. This approach is consistent with other traffic analyses that LSC has prepared in areas with high annual snowfall, such as the Lake Tahoe region, Park City Utah, and Aspen Colorado.

Overview of Traffic Model

A transportation demand model is a computerized representation of a transportation system. A model is useful for comparing the impacts of various growth assumptions and for evaluating alternative transportation improvement programs. Although it would also be possible to use growth factors based on the recent trends to project future traffic volumes, a model allows the use of better projections of growth within the region, accounting for subarea development. Computerized transportation models are also the best means by which to evaluate the interchange of traffic between various land uses and to consider the effects of traffic congestion on travel times and driver route choice.

Transportation models, by definition, are representations of travel choices made by individuals across a geographic area, impacting physical structures such as roads, bridges, parking areas, and intersections. Each model should rely on sound behavioral theory of how individuals make travel choices. The structure of choice sequences suggested by the model and the variables used in the model should reflect a logical process of decision-making followed by travelers in deciding when, where, and how to travel.

The travel choices of individuals are most commonly represented in the United States by what is referred to as the "four-step process." These four steps represent the thought processes of the individual. The individual makes four travel decisions, as follows: (1) the decision that a trip is necessary to fulfill some need or purpose (generation), (2) the decision where that need/purpose is best fulfilled (distribution), (3) the decision of which means is best to get there (mode choice), and (4) the decision of which route to take (trip assignment).

Geographic patterns are represented in the model by data considered to be at the heart of individual travel decisions: where people live, where people work, and where people recreate, shop, or otherwise interact. Land use quantities are represented in a series of Traffic Analysis Zones (TAZs), that together encompass the entire traffic model area. A total of 152 TAZs were defined to encompass the model area. TAZs were generally defined to follow property lines and to accurately reflect vehicular access to/from the roadway network. As discussed in detail below, land use quantities were developed to reflect existing uses within each TAZ.

The physical structures of travel are represented through a combination of links (paths) and nodes (intersections or transfer points). Zone centroids are special types of nodes associated with both the TAZ data mentioned above and the origins and destinations of an individual's trips.

The links typically have a travel time associated with them, either explicitly given or inferred from speed and distance information.

Trip Generation

Trip ends are classified as being either a production (defined as either end of a home-based trip or origin of a non-home based trip) or an attraction (the non-home end of a home-based trip or the destination end of a non-home based trip). Separate models are typically used to predict productions and attractions. Variables used as predictors of trip productions usually include information regarding household income, auto ownership, number of workers per household, residential density, and distance of zone from the central business district. Trip attraction predictors usually include zonal employment levels, zonal floor space, and/or accessibility to the work force.

Trip Distribution

Trip distribution is the process of connecting the trip ends which have been generated for each of the analysis areas or TAZs. It is during this step that the linkage is made between all the trip productions and attractions. Trip distribution is a significant element of the process because the trips between zones (trip interchanges) must eventually be accommodated by the transportation system. The distribution of trips is essential to estimating the traffic volumes on individual links and determining a level of service.

Mode Split

Mode split is the process that converts person trips into different modes. The Mammoth Lake Traffic Model mode split is used to turn person trips into vehicle or transit trips. The mode split estimates by the model is shown in Table 4. As the table indicates, 8 to 11 percent of the model-generated trips are assumed to occur on transit over the course of a typical winter Saturday. Note that mode split for skiers traveling to and from the Mammoth Mountain portals is substantially higher – on the order of 30 percent – which is also reflected in the model.

Trip Assignment

Trip assignment models are used to estimate traffic flow on the network, using the origin-destination pairs generated in trip distribution. The assignment of trips to the network relies on the determination of routes through the network based on the impedance or travel time of each link.

Model Validation

As with any representation of a real system, there are associated limitations. To minimize the effects of these limitations, the updated model has been "validated" so that it matches reality for all critical links in the system. In other words, adjustments were made until the modeled traffic volumes approximated existing traffic volumes, often referred to as "ground counts." Once the model was validated, then and only then can the model be used to estimate future travel patterns and volumes.

To validate the model, the results of the model traffic assignments were compared to the observed traffic volumes. The approach to the validation process is to conduct a point

validation analysis. Point validation represents a higher standard for calibration than is typically used. Not only are overall flows of traffic volumes compared, but also site-specific volumes. A calibrated model should provide results which are reasonably close for major links in the street network. Table 5 shows the two-way volume error range which was used in validating the model. For low-volume links, a larger error range is acceptable because of the lack of congestion. A difference of 100 percent for volumes less than 100 vehicles per hour has little effect on congestion because less roadway capacity is being used. For higher volume roadways, the percentage error must be much smaller. The traffic model was validated for all 36 locations evaluated.

Caltrans has established several standards for the validation of traffic models, as established in Travel Forecasting Guidelines (California Department of Transportation, November 1992). Two examples of these standards are applied to the Mammoth Lakes Model as follows:

- A minimum of 75 percent of the roadway links should be within their maximum desirable deviation, which ranges from approximately 5 to 60 percent depending on total volume. As the Caltrans standards are meant to be applied to models which generally do not contain local collectors, such as the Mammoth Model does, the maximum percent desirable deviation identified in Table 5 was assumed to be more appropriate than those identified in the Caltrans model. *Using these percent deviations, the Mammoth Lakes Model results indicate that 100 percent of the link volumes evaluated are within the acceptable error ranges, substantially exceeding Caltrans' 75 percent standard.*
- The model-wide correlation coefficient should be greater than 0.88. *The Mammoth Lakes Model traffic model results indicate a correlation coefficient of 0.99, substantially exceeding Caltrans' standard.*
- The maximum acceptable Root Mean Square Error (RMSE) should not exceed 40 percent. *The Mammoth Lakes Model model results in a RSME equal to 11 percent, substantially exceeding Caltrans's 40 percent standard.*

Future Model Assumptions

The land uses assumptions that were used in the model runs were developed by Mammoth Lakes Transportation Planning Staff. Four 2024 land use alternatives were evaluated. No new roadways were assumed to be built between 2004 and 2024.

It should be noted that any community-wide traffic model is a planning level "tool" and necessarily reflects a simplification of the roadway network, individual property access, and land uses. Detailed evaluation of individual roadway elements based upon specific project site plans, therefore, may yield differing results. The model, however, is more than adequate for purposes of overall planning for Mammoth Lakes transportation network, and meets or exceeds the standards of the traffic engineering profession.

Table 1: Level of Service Delay Criteria for Signalized and Unsignalized Intersections

Level Of Service	Control Delay per Vehicle (seconds)	
	Signalized Intersections	Unsignalized Intersections
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50
Shading indicates Town of Mammoth Lakes LOS Standard		
Source: 2000 Highway Capacity Manual.		

Table 2: Level of Service Standards for Rural Jurisdictions by Roadway Classification

Roadway Classification	Minimum Level of Service Standard								
	Mammoth Lakes	Tuolumne County	Amador County ⁽¹⁾	Lake County	Siskiyou County	El Dorado County	Nevada County	Town of Truckee	TRPA ⁽³⁾
State Highways	D	E	C/D	C	C	E (urban) D (rural)	D (urban) C (rural)	D, except E within Downtown area.	D
Arterial	D	C ⁽²⁾	C/D	C	C	E (urban) D (rural)	D (urban) C (rural)	D, except E within Downtown area.	D
Collector	D	B ⁽²⁾	C	C	C	E (urban) D (rural)	D (urban) C (rural)	D, except E within Downtown area.	D
Local Roads	D	B ⁽²⁾	C	C	C	E (urban) D (rural)	D (urban) C (rural)	D, except E within Downtown area.	D
<p>Note 1: Major intersections with a 15 minute peak period of LOS D is allowed. Certain state highway road segments are also allowed LOS D.</p> <p>Note 2: One LOS standard lower is allowed within 1/2 mile of intersections with major collectors and arterial highways. For example, in Tuolumne County LOS B is required along all collectors, excepting those within 1/2 mile of a major collector or arterial highway, for which a LOS C must be maintained.</p> <p>Note 3: LOS E is allowed at signalized intersections for no more than 4 hours per day.</p> <p>Source: County planning documents.</p>									

Table 3: 2003/2004 Winter Daily Traffic Volumes Along Main Street East of Minaret Sorted from Highest to Lowest

Winter Rank	Day of Week	Date	Daily Traffic Volume		Total
			Eastbound	Westbound	
1	Saturday	14-Feb-04	8,743	8,042	17,785
2	Wednesday	31-Dec-03	8,642	8,604	17,646
3	Sunday	15-Feb-04	8,989	8,054	17,023
4	Saturday	17-Jan-04	8,263	8,614	16,907
5	Saturday	24-Jan-04	8,163	8,260	16,452
6	Sunday	26-Dec-03	8,493	7,913	16,406
7	Saturday	27-Dec-03	8,182	8,203	16,395
8	Saturday	26-Feb-04	8,018	8,110	16,130
9	Friday	13-Feb-04	7,499	8,593	16,051
10	Saturday	31-Jan-04	7,886	7,890	15,756
11	Monday	22-Dec-03	8,051	7,702	15,753
12	Sunday	16-Jan-04	8,370	7,290	15,670
13	Tuesday	30-Dec-03	7,985	7,434	15,419
14	Friday	30-Jan-04	7,379	8,012	15,391
15	Friday	23-Jan-04	7,228	8,157	15,388
16	Saturday	30-Dec-03	7,738	7,755	15,356
17	Saturday	13-Mar-04	7,850	7,567	15,247
18	Saturday	21-Feb-04	7,831	7,509	15,131
19	Monday	16-Feb-04	8,517	6,596	15,113
20	Sunday	25-Jan-04	8,405	6,615	15,020
21	Friday	05-Mar-04	7,185	7,789	14,974
22	Saturday	07-Feb-04	7,354	7,473	14,827
23	Friday	26-Dec-03	7,207	7,585	14,792
24	Friday	03-Jan-04	7,187	7,574	14,761
25	Sunday	29-Feb-04	8,552	6,196	14,748
26	Saturday	20-Mar-04	7,393	7,342	14,735
27	Saturday	10-Jan-04	7,382	7,337	14,719
28	Friday	06-Feb-04	6,833	7,812	14,645
29	Friday	16-Jan-04	6,894	7,829	14,523
30	Sunday	08-Feb-04	8,143	6,252	14,395
31	Saturday	27-Mar-04	7,105	7,181	14,286
32	Monday	29-Dec-03	7,341	6,889	14,230
33	Sunday	07-Mar-04	8,137	6,073	14,210
34	Friday	12-Mar-04	6,755	7,353	14,108
35	Friday	20-Feb-04	6,909	7,198	14,107
36	Saturday	03-Jan-04	7,572	6,414	13,986
37	Tuesday	23-Dec-03	7,212	6,743	13,955
38	Friday	27-Feb-04	6,542	7,393	13,935
39	Friday	02-Jan-04	7,249	6,255	13,804
40	Friday	19-Mar-04	6,476	7,080	13,556
41	Sunday	14-Mar-04	7,816	5,787	13,383
42	Sunday	01-Feb-04	7,650	5,706	13,358
43	Saturday	20-Dec-03	6,409	6,909	13,318
44	Thursday	08-Jan-04	6,686	6,629	13,317
45	Monday	18-Jan-04	7,712	5,556	13,268
46	Sunday	26-Mar-04	7,405	5,880	13,285
47	Sunday	04-Jan-04	7,326	5,939	13,265
48	Thursday	19-Feb-04	6,584	6,677	13,261
49	Sunday	21-Dec-03	6,708	6,556	13,256
50	Friday	26-Mar-04	6,329	6,910	13,239
51	Sunday	11-Jan-04	7,256	5,804	13,059
52	Sunday	21-Mar-04	7,338	5,502	12,840
53	Friday	19-Dec-03	6,688	6,253	12,942
54	Monday	05-Jan-04	6,329	5,962	12,311
55	Tuesday	09-Jan-04	6,133	5,876	12,009
56	Thursday	26-Jan-04	5,699	6,219	11,918
57	Thursday	12-Feb-04	5,773	6,035	11,808
58	Sunday	22-Feb-04	6,774	5,016	11,790
59	Wednesday	07-Jan-04	6,030	5,714	11,744
60	Thursday	04-Mar-04	5,637	5,828	11,565
61	Thursday	11-Mar-04	5,670	5,864	11,534
62	Thursday	22-Jan-04	5,480	5,945	11,425
63	Wednesday	24-Dec-03	5,670	5,889	11,359
64	Monday	02-Feb-04	6,011	5,244	11,255
65	Thursday	05-Feb-04	5,475	5,769	11,244
66	Monday	29-Mar-04	5,888	5,354	11,242
67	Monday	26-Jan-04	5,904	5,243	11,237
68	Thursday	16-Mar-04	5,579	5,637	11,210
69	Thursday	16-Dec-03	5,331	5,515	11,046
70	Thursday	15-Jan-04	5,499	5,519	11,018
71	Monday	09-Feb-04	5,917	5,094	11,011
72	Monday	08-Mar-04	5,782	5,126	10,888
73	Wednesday	14-Jan-04	5,503	5,245	10,748
74	Monday	15-Mar-04	5,020	5,085	10,705
75	Tuesday	17-Feb-04	5,408	5,294	10,673
76	Wednesday	31-Mar-04	5,420	5,163	10,583
77	Thursday	25-Mar-04	5,243	5,314	10,557
78	Tuesday	09-Mar-04	5,384	5,049	10,413
79	Wednesday	17-Dec-03	5,293	5,102	10,395
80	Monday	12-Jan-04	5,436	4,953	10,392
81	Tuesday	19-Dec-03	5,287	5,090	10,357
82	Tuesday	13-Jan-04	5,295	5,037	10,332
83	Wednesday	11-Feb-04	5,254	5,070	10,324
84	Wednesday	17-Mar-04	5,234	5,071	10,305
85	Monday	22-Mar-04	5,416	4,833	10,249
86	Monday	15-Dec-03	5,197	5,031	10,228
87	Wednesday	18-Feb-04	5,153	5,054	10,207
88	Tuesday	30-Mar-04	5,289	4,906	10,205
89	Tuesday	10-Feb-04	5,233	4,950	10,183
90	Wednesday	10-Mar-04	5,223	4,917	10,140
91	Monday	23-Feb-04	5,327	4,777	10,104
92	Tuesday	24-Feb-04	5,168	4,751	9,919
93	Wednesday	03-Mar-04	5,025	4,871	9,896
94	Wednesday	21-Jan-04	4,988	4,894	9,882
95	Tuesday	16-Mar-04	5,078	4,755	9,833
96	Monday	01-Mar-04	5,211	4,593	9,804
97	Wednesday	26-Jan-04	4,925	4,787	9,712
98	Wednesday	04-Feb-04	4,941	4,729	9,670
99	Tuesday	23-Mar-04	5,010	4,626	9,636
100	Wednesday	24-Mar-04	4,768	4,548	9,316
101	Tuesday	20-Jan-04	4,681	4,602	9,183
102	Thursday	01-Jan-04	4,894	4,225	9,069
103	Tuesday	27-Jan-04	4,582	4,336	8,918
104	Tuesday	03-Feb-04	4,554	4,128	8,682
105	Tuesday	02-Mar-04	4,284	4,176	8,442
106	Thursday	25-Dec-03	3,981	4,297	8,258
107	Thursday	26-Feb-04	3,822	4,049	7,871
108	Wednesday	25-Feb-04	3,512	3,339	6,851

Percent Difference Between Design Day and Peak Day Traffic Volume 86%

Table 4: Transit Mode Split Estimated by Mammoth Model by Land Use Alternative

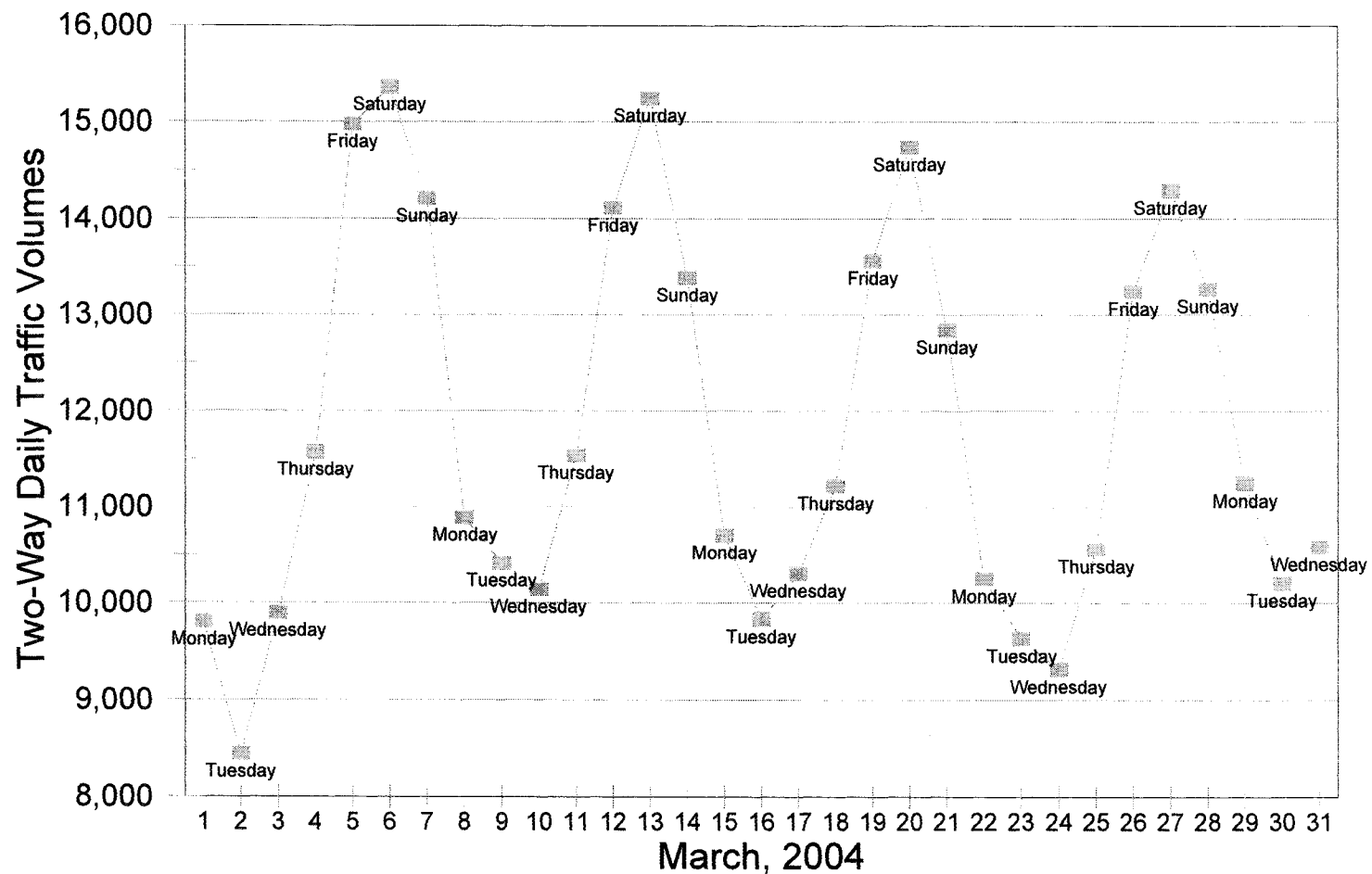
Alternative	Off-Peak Transit Trips	Peak-Hour Transit Trips	Total Daily		
			Bus Person Trips	Total Person Trips	Mode Split (% Using Bus)
2004	10,988	1,680	12,668	165,626	7.65%
2025 Build Out of Alternative 1	20,620	3,328	23,948	295,360	8.11%
2025 Build Out of Alternative 2	28,209	4,845	33,054	316,288	10.45%
2025 Build Out of Alternative 3	22,509	3,619	26,128	315,401	8.28%
2025 Build Out of Alternative 4	18,913	3,040	21,953	267,040	8.22%

Note: This mode split represents the mode split for all trips in the Mammoth Transportation Demand Model and not just skier trips.

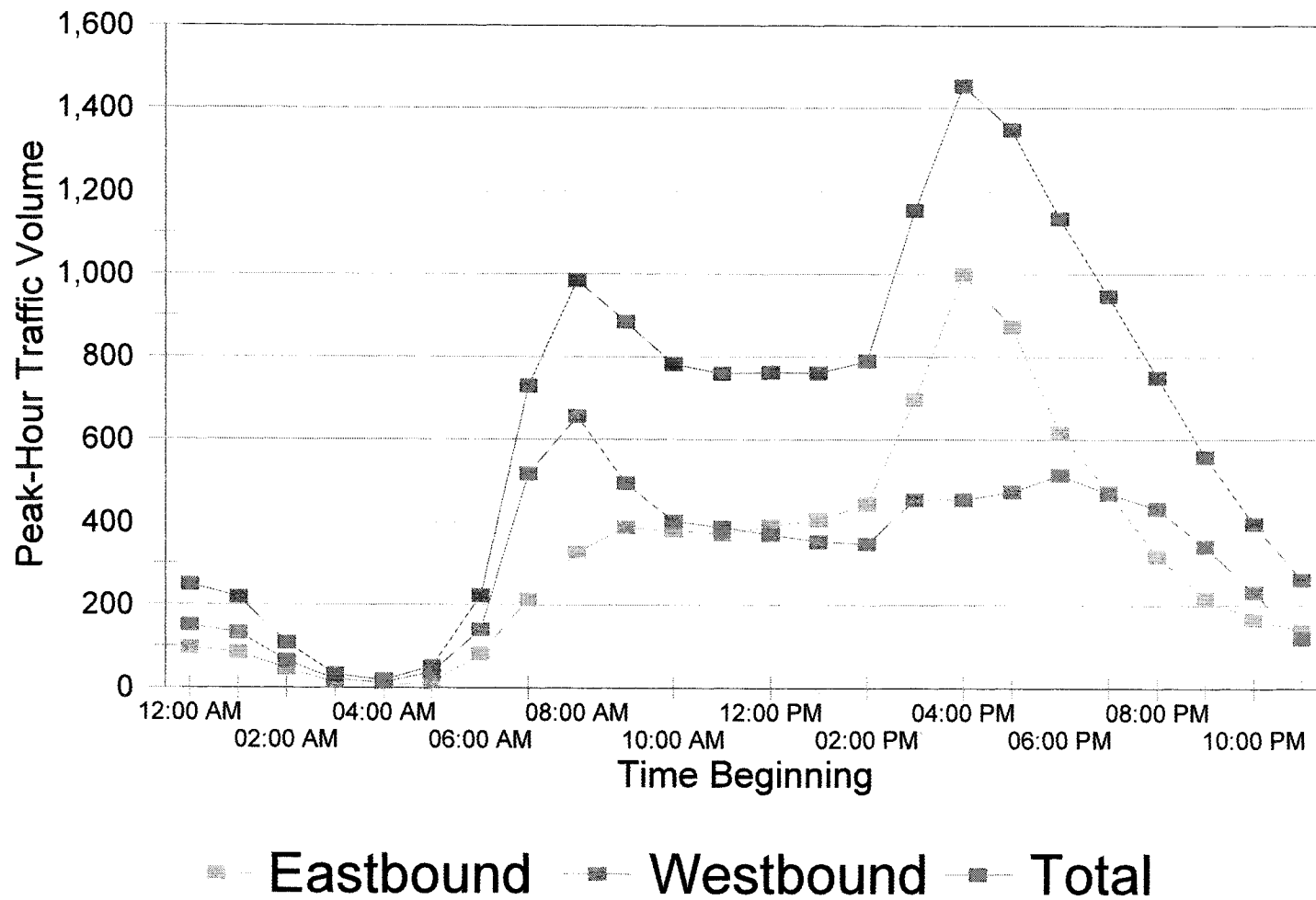
Mode Split.wb3

Table 5 Point Validation Error Range	
Peak Hour Two-Way Traffic Volumes	Error Range + (-)
<100	100%
100-399	50%
400-999	25%
1,000-1,500	15%
>1,500	10%

Figure 1: Daily Variation in Traffic Volumes Along Main East of Minaret



**Figure 2: Peak-Hour Traffic Volumes
Main East of Minaret (March 6, 2004)**



**Figure 3: Daily Traffic Volumes Along
Main East of Minaret
(December 15, 2003 - March 31, 2004)**

